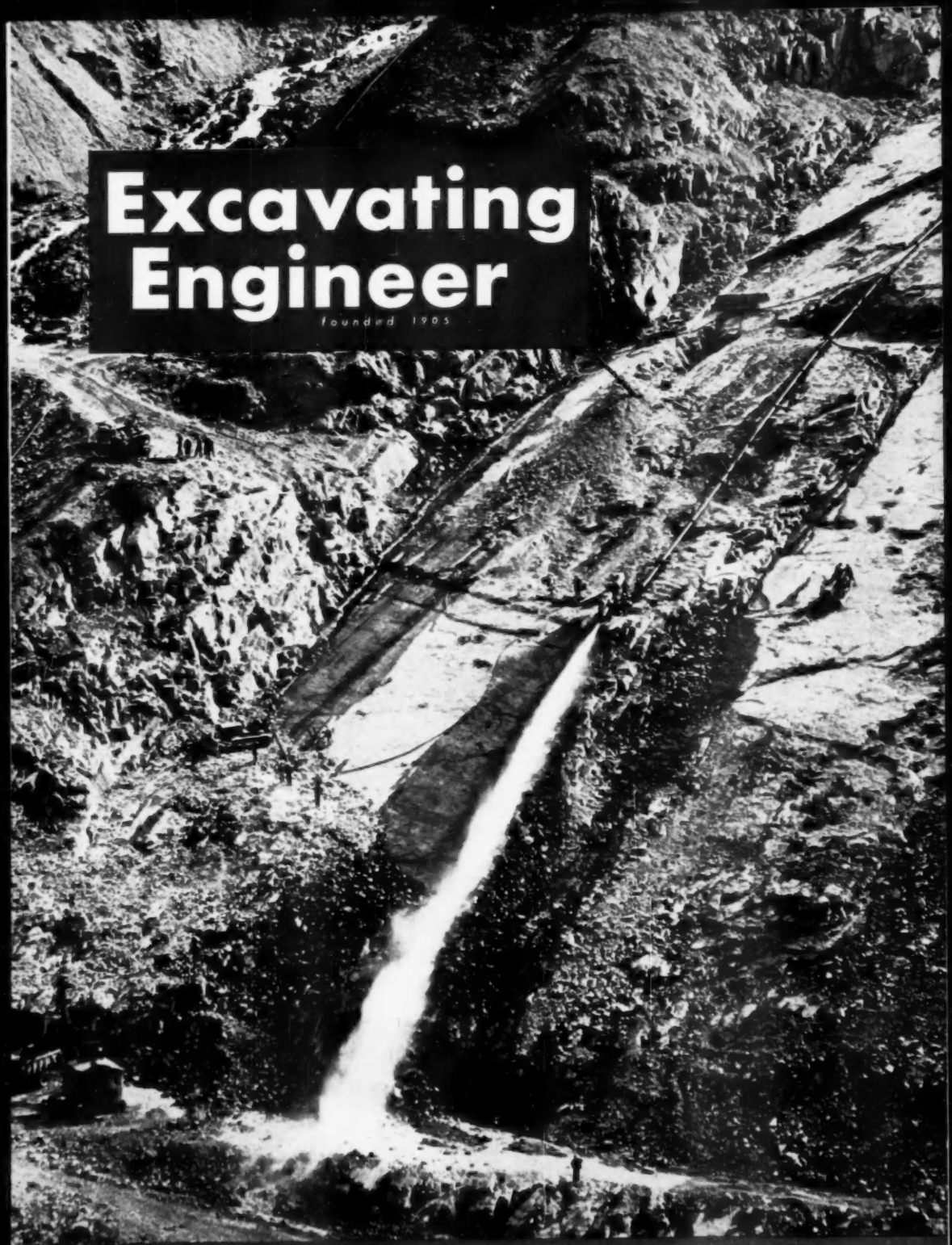
Excavating Engineer

founded 1905



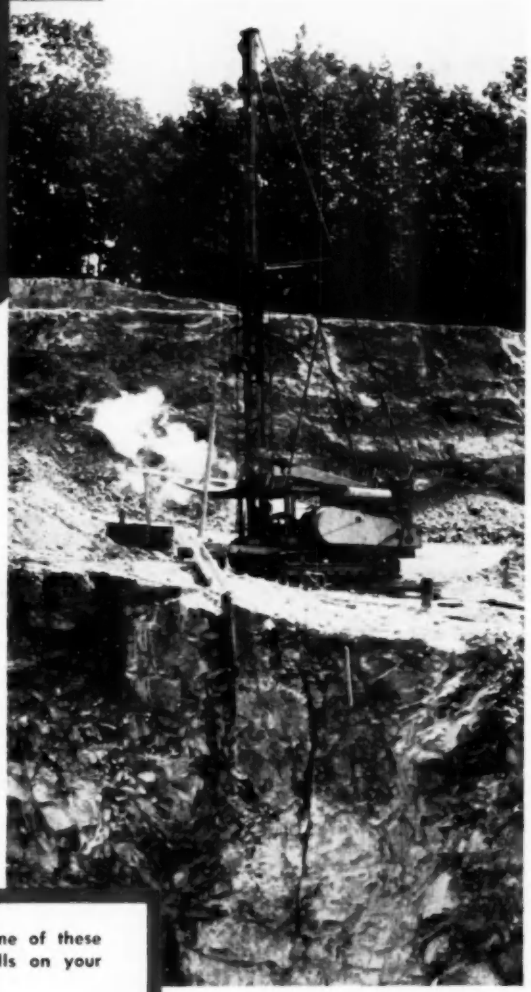
A 75m million-yd. foundation excavation at western Montana's Hungry Horse Dam passes the three-quarter mark as hydraulic shoving operations and dozers push down loose rock from abutment.

September, 1949

$ $ $ $ $ $ $ $

FEWER HOLES PER TON OF ROCK

How Bucyrus-Erie Blast Hole Drills Can Save You Money



MONEY-WISE mine and quarry owners have found that with Bucyrus-Erie blast hole drills less actual drilling is necessary, fragmentation is improved. The net result is savings in preparation costs amounting to as much as 50%. Here are the reasons why:

1. With Bucyrus-Erie blast hole drills you need drill less total footage than is necessary with tripod or wagon drills, because the holes are larger (5⅝" to 12") and thus can be spaced farther apart. Loading time is reduced.

2. Heavy tool strings and efficient drilling action produce the sharp, shattering blows that mean speedy penetration. Caterpillar mountings reduce moving time.

3. Fragmentation obtained is usually more uniform, requiring less secondary blasting, yet the amount of powder used per ton of rock blasted is about the same.

25846C

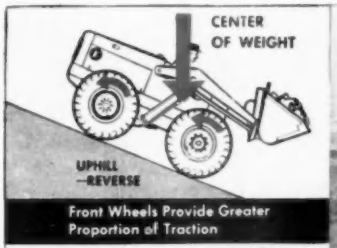
You'll be geared for extra savings with one of these tough, hard-hitting Bucyrus-Erie blast hole drills on your location:

22-T	**5⅝"**	**to**	**6⅝"**	**holes**
27-T	**6"**	**to**	**6⅝"**	**holes**
29-T	**6"**	**to**	**9"**	**holes**
42-T	**9"**	**to**	**12"**	**holes**

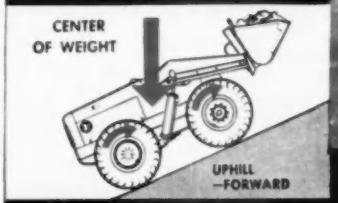
Gasoline or electric power is available for all machines . . . diesel for all except the 22-T.

BUCYRUS ERIE

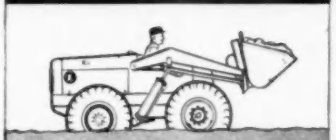
SOUTH MILWAUKEE, WIS.



Front Wheels Provide Greater Proportion of Traction

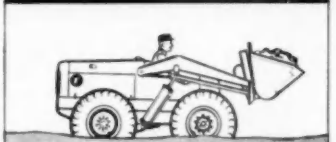


Rear Wheels Provide Greater Proportion of Traction



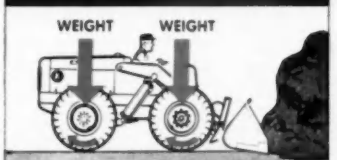
MUD

All Wheels Provide Traction



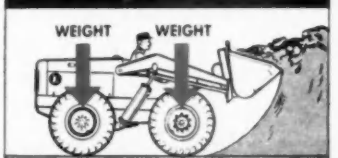
SAND

All Wheels Provide Traction



CROWDING ACTION

More Traction At Rear When Thrusting Into Pile



SCOOPING ACTION

More Traction At Front When Scooping Up Load

with 4 Wheel Drive!

Here is an entirely new experience in earthmoving — an entirely new conception of the work capacity and job capacity of a rubber tired tractor shovel. Here is an entirely new tractor shovel—revolutionary in design—revolutionary in performance.

Big and powerful, the 1½ Yd. Model HM PAYLOADER provides tremendous digging power and ground-gripping traction for tough going in rock, sand, mud, muck or *any* terrain. With 4-Wheel Drive on large rubber tires it provides traction comparable to a crawler tractor—plus more speed, greater mobility, easier maneuverability and *far less maintenance expense.*

Compact design, short wheel base and power boosted rear wheel steering enable the HM to operate in close quarters. It has four speeds in either direction and quick acting forward-reverse control. Double acting finger-tip hydraulic control raises — lowers — dumps and closes the bucket . . . provides powerful down pressure for tough digging. Get the complete story on this new PAYLOADER from The Frank G. Hough Co., 708 Sunnyside Avenue, Libertyville, Illinois.

1½ Cu. Yd. Capacity
Hydraulic Bucket Control
Hydraulic Down-Pressure
Rear-Wheel Power Steering
Automatic Tip-Back Bucket
Four Forward Speeds
2 to 16 mph
Four Reverse Speeds
3 to 24 mph

WRITE for full information on any size of Payloader: the 1½ yd. Model HM; the 1¼ yd. Model HL; the ¾ yd. Model HF; the 10½ cu. ft. Model HA.

HOUGH
PAYLOADER
Manufactured by THE FRANK G. HOUGH CO.

These Vital Parts fit *ALL* GM "71" DIESELS

Every GM Series 71 Diesel engine, whether a two-cylinder or one of a Quad 6, *has the same bore and stroke.* This means that practically all moving parts are exactly the same for any size Series 71 engine from 43 to 520 continuous B.H.P.

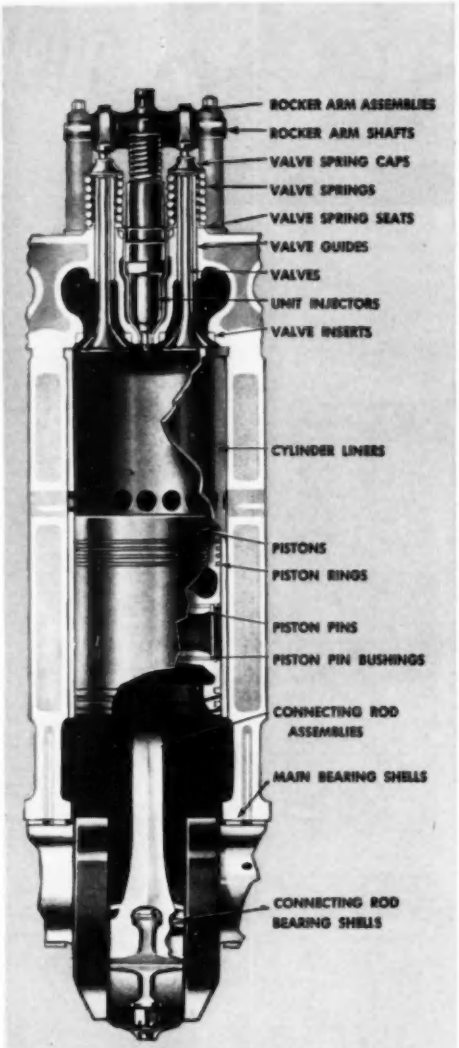
For example, all of the GM Diesel parts shown here, plus dozens more, are completely interchangeable, regardless of the number of cylinders, horsepower, age or usage of the engine.

To large contractors, oil drillers, truck or boat fleet operators, this unique feature of GM Diesel design means lower parts inventories and less time out for maintenance.

To the individual owner, it brings a no less important benefit. A *single* inventory of basic parts on the distributor's shelves increases the availability to owners of the *right* part when it is needed.

Maximum parts interchangeability is just one of the many *plus* values that go with your purchase of General Motors Diesel engines—a good reason why it pays to *standardize* on GM Series 71 Diesels.

For topmost satisfaction and reliability, always buy genuine "Factory-Engineered" GM Diesel parts from your authorized distributor or dealer.



CUTAWAY OF CYLINDER FROM GM SERIES 71 DIESEL

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES...Up to 200 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS...Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

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Excavating Engineer

founded 1905

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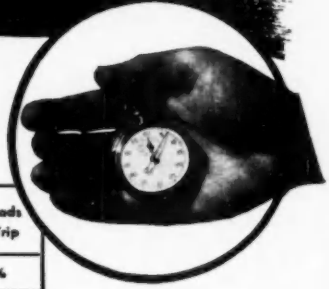

Type of Bucket	Load Time	Dump Time	Jockeying Time	Total Time	Full Loads Each Trip
AUTOMATIC	3 to 7 sec.	2 to 4 sec.	0 sec.	5 to 11 sec.	100%
Ordinary Type	7 to 16 sec.	4 to 7 sec.	2 to 6 sec.	13 to 29 sec.	85%

THESE are the facts proven by numerous tests made recently between the Page AUTOMATIC and ordinary type buckets, using all sizes from ⅜ to 30 cu. yd. in various types of digging conditions.

The AUTOMATIC always gets a full load within 1 to 2 bucket lengths and can be picked up immediately without spilling while ordinary buckets have to be pulled at least 4 to 6 bucket lengths to get and hold their loads. Another point about the AUTOMATIC—it is always the correct weight for maximum digging efficiency. "Light-weight" buckets of larger "rated" capacity cannot match the profit-making ability of a Page. For more yardage per day, lower power costs and minimum maintenance, be sure your next dragline bucket is a Page AUTOMATIC.

9 cu. yd. AUTOMATIC on a Page Model 625 Dual Diesel Walking Dragline with 150′ boom.

GET THE FACTS TODAY

Call or write for details on how to make a time study with your own stop-watch for positive proof—or better still, ask for a Page engineer to call and prove these facts without any obligation.

25 to 45% less power required for day-after-day operation because the AUTOMATIC loads, dumps and handles faster.

Less maintenance because the AUTOMATIC is not worn out through excessive dragging to get its load.

The AUTOMATIC always lands in digging position, digs in at first pull on the load line and never produces windrows.

Send for Bulletin 2049

PAGE *Automatic*

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PAGE ENGINEERING COMPANY

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In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer—is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant—Palmer, Mass.

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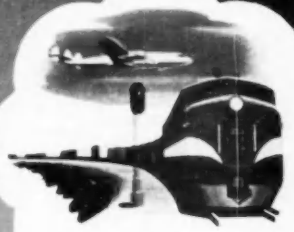
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1060—19th Ave., Oakland 6, Cal.

LOGGING



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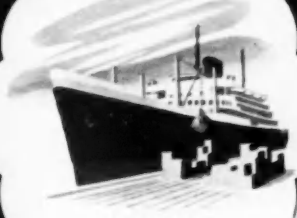


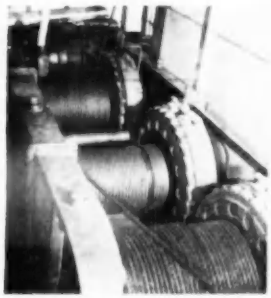
MARINE

CONSTRUCTION

A. L. Brotman

swing and hoist ... Electrically

G-E equipped Colby crane at work on site of Granby Pumping Station



Hoist assembly consists of cable drums and General Electric 100-hp motor

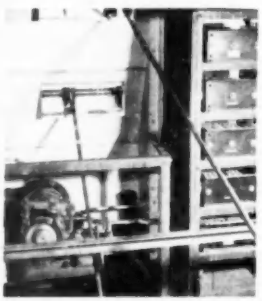
Operator at controls of Colby crane, spotting loaded concrete buckets

Colby Crane Helps Granby Constructors Shorten Schedule

Here's the "sky hook" that's accelerating concrete placing operations at Granby Pumping Station, heart of the Bureau of Reclamation's Colorado Big Thomson project. The crane is built by Colby Steel and Engineering Company of Seattle and embodies the latest and most efficient electric drive and safety devices.

Machinery manufacturers and contractors alike are realizing the time and money economies of *electrically* driven construction equipment. And by specifying General Electric they get the additional advantages of engineering assistance in application, installation and service wherever the job may be.

Inspection and maintenance of the G-E control equipment is easy



Swing motor and resistor assembly are compact, yet readily accessible

Ask him Today!

Whether you use or build construction equipment, your G-E representative can show you how to do a better job at lower cost by complete electrification. He will be glad to call on you at your convenience. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Electrified Construction
BETTER PRODUCT
LOWER COST

GENERAL ELECTRIC

PULLSHOVEL JOBS AHEAD—

DON'T BUY A ONE-PURPOSE MACHINE!

HANDLING PIPE

BASEMENT EXCAVATION

SEWER WORK

YOUR Northwest Pullshovel is one of the most versatile tools in the "deck." Sewer trench and waterline trench—wide, narrow, deep, shallow—are handled fast and easily. Northwest gives you plenty of boom for deep digging or side casting.

On basement work your Northwest stays out of the hole—a time-saving feature if the "going" is wet. Water entry line and electric line trench can be handled practically in the same cut. Your Pullshovel has proved successful even on road work and handles the parallel ditch all at the same time.

Your shovel equipment on work like this is in the heart of the job and you can't afford anything but the best for the heart of the job. Don't buy a one-purpose machine. Plan now to have a proved Northwest Pullshovel for the *Key Spots* where the profit begins. Remember it is convertible to a standard shovel, crane or dragline Ask for details.

NORTHWEST ENGINEERING CO.
1506 Field Building
135 South LaSalle St.
Chicago 3, Illinois

only the best for the heart of the job

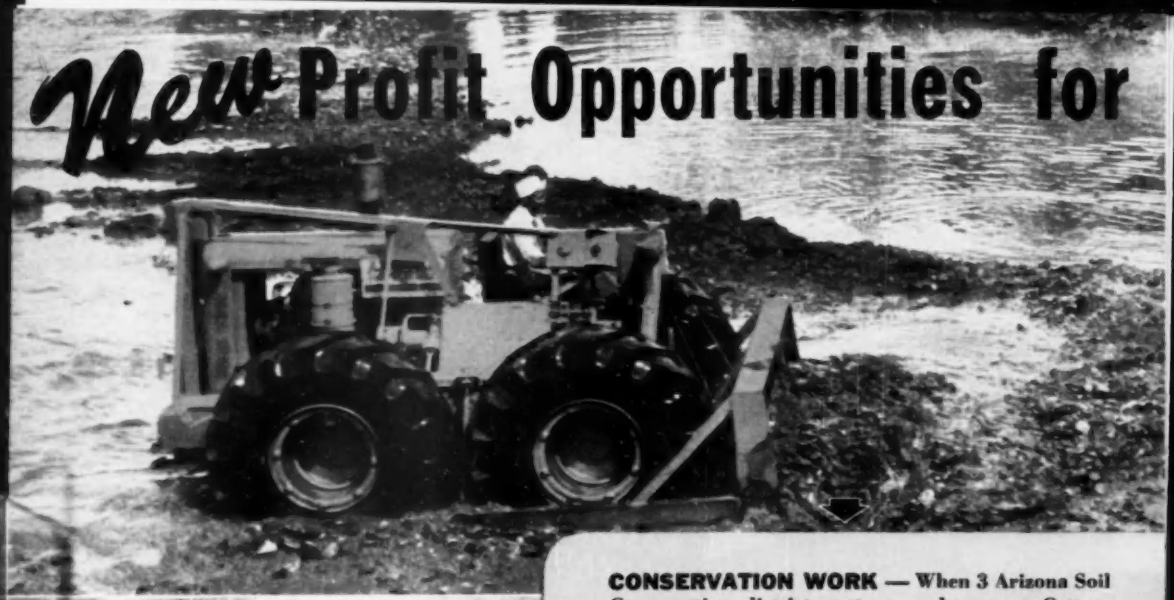
MAKE YOUR KEY MACHINE A REAL ROCK SHOVEL

PROFIT

NORTHWEST

CRAWLER and TRUCK MOUNTED SHOVELS • CRANES • DRAGLINES • PULLSHOVELS

New Profit Opportunities for



CONSERVATION WORK — When 3 Arizona Soil Conservation districts put on a show near Cottonwood, 4000 Southwestern ranchers watched C Tournadozer dig a 4000-yd. stockpond . . . clear 1 acre of mesquite . . . and straighten Verde River channel, all in 1 day. High-speed, rubber-tired "C" was driven 152 miles over highway to project from Phoenix.

PIT CLEAN-UP — Dozing spoil, handling pit clean-up and mine maintenance jobs at AuBuchon silica mine near Crystal City, Missouri, rubber-tired "C" drew high praise from owner E. J. AuBuchon: "The speed and maneuverability of this machine makes it easy to do 4 or 5 times as much work as a crawler" . . . he added, "C Tournadozer is far superior to any crawler-type tractor we have used.

COAL HANDLING — When fire broke out at bottom of 20,000-ton coal stockpile, Mississippi Lime and Cement Co., St. Genevieve, Mo., figured it would take 2 weeks to move the pile. After trying several methods, they brought in a C Tournadozer . . . completed job and licked fire in only 7 days! Operator often had to wait for smoke to clear after each pass before he could make another cut.

SNOW REMOVAL — Contractor Frank Halverson, Bonesteel, S. D., equipped his Tournadozer with new LeTourneau V snow plow . . . during "Operation Snowbound" worked 24 hours a day through 27 inches of snow, clearing 300 miles of drift-blocked county highways, and 150 miles of township roads in Gregory County. In 10 days, Halverson's high-speed Tournadozer opened a total of 450 miles of road, some that had been closed for 2 weeks.

Mail today to: R. G. LeTOURNEAU, Inc., Peoria, Illinois

Please send me additional information on the 180 h.p. C Tournadozer: ☐ *Specifications* ☐ *Price* ☐ *Delivery* ☐ *Where to see*

NAME_____ TITLE_____

COMPANY_____ TYPE OF BUSINESS_____

STREET_____ CITY, STATE_____

Also send information on: ☐ *13.3-yd. C Tournapull* ☐ *7-yd. D Roadster*

You on Year 'Round DOZER Work

FAST PUSHER SERVICE—Elmer Anderson used 2 C Tournapulls and 1 C Tournadozer to re-grade Minnesota county roads. Tournadozer pusher-loaded 10 to 11 pay yards of loam and clay to each Tournapull in average of 36 seconds. "Performing beyond my expectations," says Contractor Anderson.

EMERGENCY ROAD REPAIRS—To clear heavy mountain-top landslide from highway near Viota, Colombia — Zona de Bogata drove their C Tournadozer over 104 mi. in 7½ hrs. . . . reached job at 9:30 AM . . . moved 4000 yds. of dirt and debris in 13 hours . . . had road opened to traffic by 10:30 PM.

PULLING HEAVY EQUIPMENT — Skidding heavy compressor is one of many maintenance jobs Tournadozer handles around Interstate Iron Co. mines near Calumet, Minn. "C's" big, 180 h.p. Diesel engine and 4-wheel drive develop plenty of drawbar pull to add extra profits as prime mover.

STRIPPING—To clean coal seam along Kentucky mountainside, Three Point Coal Co. strips along 45′ cliff face. Overburden is 90% rock . . . blasted, then dozed off edge. It's rough going, but, reports Superintendent Rhodes, Tournadozer "does about twice work of crawler on straight dozing".

High-speed, rubber-tired Tournadozer is good insurance against the future . . . assures you the pick of the jobs against any kind of competition. Check the new profit opportunities it offers you . . . write, or see your LeTOURNEAU DISTRIBUTOR TODAY.

LETOURNEAU PEORIA, ILLINOIS — JOB-PROVED Over 6250 Built and Shipped — **TOURNADOZERS**

IT'S RUBBER THAT PUTS THE ACTION IN TRACTION

FLEETS OF A-C's

PROJECT: Garrison Dam on Missouri River, N. D. — Stage II of the World's Largest Rolled-Earth Fill Dam.

CONTRACTORS: Peter Kiewit Sons' Co. and Morrison-Knudsen Co.

42 HD-19 HYDRAULIC TORQUE CONVERTER TRACTORS

PULL and PUSH BIG LOADERS (right)—Heavy, powerful HD-19's keep big loaders operating at capacity in the tough going. Synchronize speeds — start and stop with throttle . . . no constant clutching. Spillage is negligible, there's less wear and tear on loader and tractors.

BOOST HAULING UNITS — HD-19's with pusher plates, "patrol" the job . . . keep the heavily loaded wagons moving through the mucky material. Catch them quickly, make a smooth contact and stay with 'em — match speeds exactly.

HANDLE ALL TYPES OF BULLDOZING (right)—Fleets of '19's, with matched 'dozers, are everywhere, speeding up every job — clearing, leveling fills, cleaning up around shovels, sloping, building haul roads, pulling equipment. High reverse — to 5.5 m.p.h. No worrying about overloads — can't kill engine.

PULL SCRAPERS, ROLLERS, OTHER EQUIPMENT — Big, sure-footed, better-balanced HD-19's really bear down and lug on every hauling job. Automatically move equipment as fast as load and ground conditions permit — up to 3.0 m.p.h. in low, to 7.0 m.p.h. in high.

help rush big job

12 MODEL AD MOTOR GRADERS

KEEP HAUL ROADS SMOOTH — A continuous procession of big hauling units tear, whip and grind the earth as they travel. Keeping the way smooth, to keep the material moving fast, is the job assigned to the fleet of A-C Motor Graders . . . plus cutting and sloping banks. Strong, powerful, fast, diesel-powered Allis-Chalmers Motor Graders can "take on" the toughest jobs, handle them smoothly, quickly, at lowest possible cost. Only A-C Motor Graders have the "Roll-Away" Moldboard — less power required to move more material at faster speeds.

HD-5 WITH TRACTO-SHOVEL

VERSATILE — There's no limit to the applications of this outfit with its many interchangeable attachments. Here it picks up oversize rock from the fill with specially designed forks. Small stones go through the forks, the big ones remain — and are loaded into trucks. Think of the savings on man-hours! Other attachments include various sizes and types of buckets, bulldozer blades and a "V" snowplow.

ALLIS-CHALMERS ...Originator of the Torque Converter Tractor

TRACTOR DIVISION · · MILWAUKEE 1 U S A

Break IT UP with PRIMACORD

. . . and take it away. Good digging means lower costs per yard, more yards per minute.

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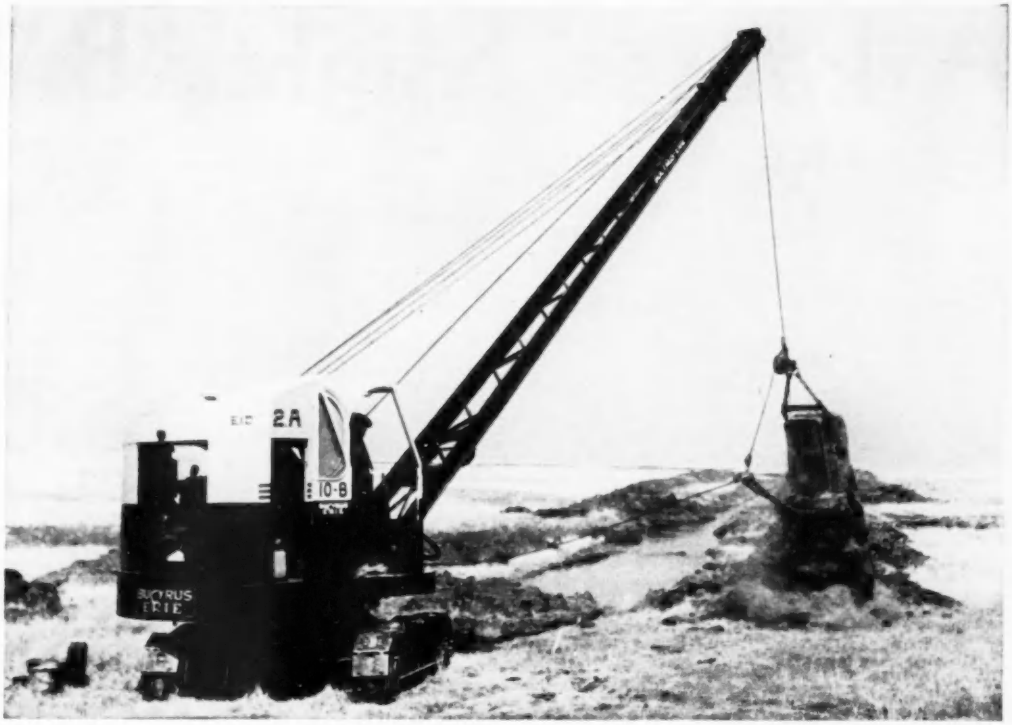

A long drink for thirsty acres

Digging and maintaining thousands of miles of irrigation ditches requires a fast, efficient excavator that stays on the job with minimum time out for maintenance. That means a Bucyrus-Erie like this speedy, dependable ⅜-yd. 10-B dragline.

Owners and operators the country over know that the 10-B spells profits on many other kinds of jobs, too. It's quickly convertible in the field . . . deck machinery is compact, easy to get at for maintenance. Top quality steels and alloys give it strength and durability. Full-feel controls help boost output every shift. See your Bucyrus-Erie distributor for complete details.

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The BEST buy Bucyrus, the best BUY in excavators

Bucyrus-Erie Company
South Milwaukee, Wisconsin

Arkansas' Mighty Bull

• From a high point west and downstream from Bull Shoals Dam the last flights of a 7-mile conveyor belt can be seen winding their way to the damsite. Service bridge crosses White River at right.

Thirty years of planning designed to bring the rampaging White River under control will soon bear fruit with completion of Bull Shoals Dam, near Mountain Home in northern Arkansas. Flippin Materials Co., is quarrying and delivering by a 7-mile conveyer belt, 2,000,000 cu. yd. of rock for aggregates to Ozark Dam Constructors—holder of the $22 million construction contract.

by Robert J. Green

"WELL, gentlemen, the White River will be tamed forever," the head draftsman said, looking over the last preliminary sheet of plans for Bull Shoals Dam, "if our field men can only find two million cubic yards of sound rock, and get it out . . . !"

In the last part of his statement lies the key to one of the greatest engineering feats ever undertaken in the Ozark Mountain country: Construction of Bull Shoals Dam across the White River near Mountain Home, Ark. The mighty barrier, designed for flood control and hydroelectric power generation, is a mass of concrete seven city blocks long, 283 feet high, and 230 feet wide at the base. Concrete aggregates, more than any other construction material, play the most vital role. Like many another material, they begin with excavation.

Crews of men, with modern drilling and rock handling machines, have swiftly roughed out a huge quarry north of Flippin, Ark. Here the only satisfactory chunk of limestone in that vicinity suitable to supply the big block of concrete masonry is being removed. The quarry face, now almost fully developed, is 900 feet long and 80 feet high. Approximately 800 feet of that monstrous block will be drilled, shot, loaded, crushed and transported over seven miles of conveyor belt line to build the dam.

It is one of the big rock excavating jobs of modern times. Drilling, blasting, loading and the other phases of rock-handling technique are being watched with interest by engineers and contractors all over the nation.

Bull Shoals Dam was designed and is being supervised by the Little Rock district office of the Corps of Engineers. Almost $32 million is invested by the Government in contracts alone. A $22,146,440 contract with Ozark Dam Constructors provides for the construction of the dam and most of the appurtenant works except the powerhouse. A $9,447,100 contract with Flippin Materials Co. covers the quarry work, delivering the rock in minus 6-in. pieces to the processing plant at the dam.

Both the Ozark Dam Constructors and the Flippin Materials Company are composed of the same joint venture contractors. These include Brown and Root, Inc., Houston, Tex., as the sponsoring company; Wunderlich Contracting Co., Jefferson City, Mo.; Morrison-Knudsen Co., Inc., Boise, Idaho; David G. Gordon, Denver, Colo.; Condon-Cunningham Co., and Peter Kiewit Sons' Co., Omaha, Neb.; J. C. Maguire, Los Angeles, Calif.; Charles H. Tompkins Co., Washington, D. C.; and Winston Brothers Co., Minneapolis, Minn.

Construction began on the huge project back in 1947, shortly after bids were opened in June. Corps of Engineer specifications allow the contractors 1,250 days to finish, and at the rate the work is speeding along at present, that schedule will probably be beaten by a good margin.

A story of the quarry operation is almost automatically a tale of Bull Shoals Dam itself. The two are inter-

Shoals

dependent. Bull Shoals Dam when completed will be among the most massive concrete dams in the United States. It will be a key unit in a system of reservoir projects for control and development of the White River and its tributaries. Its flood storage will benefit more than one million acres of land. Its power units will produce enough energy to supply a city with the combined populations of Little Rock, Tulsa, and Springfield, Mo. Its waters and surrounding lands will be used for fishing, boating, hunting, and other forms of healthful recreation.

Multi-Purpose Structure

The upper portion of the reservoir for a depth of 41 feet is provided specifically for the regulation of floods arising on the Upper White River. The remaining storage in the reservoir is provided for the development of hydroelectric power, with incidental benefits to recreation and wild life resulting from the establishment of a lake with an area about equal to two townships and a shore line four times as long as the 235-mile highway from Little Rock to Springfield.

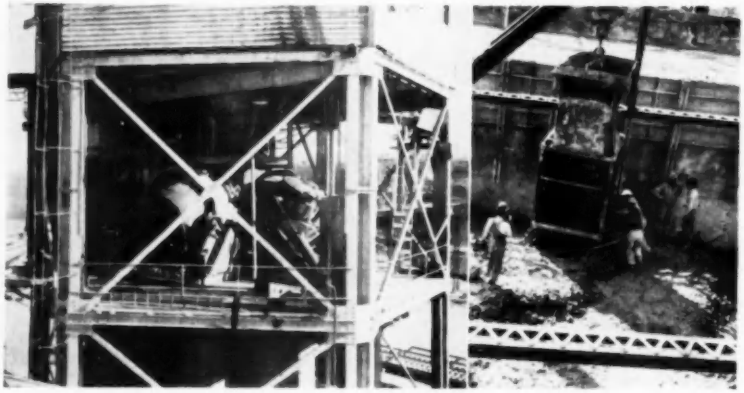
During flood periods water will be stored to prevent, so far as possible, flood stages that will damage property downstream from the dam.

Water will be stored in the flood control pool an average of about 20

• **Above: Outlined against quarry face, 5-yd. Bucyrus-Erie 120-B shovel loads limestone to 25-yd. Maxi-built Cummins-powered custom truck. On top of highwall, two Bucyrus-Erie 29-T churn drills punch 9-in. blast holes to a depth of 83 feet, three feet below quarry floor.**

• **Right: Rock screen plant transfers rock aggregate to Goodyear conveyor belt shown in background at beginning of its 7-mile run to dam.**

• **Below: When this picture was taken, 80-ft. high quarry face was not yet fully developed. Heavy pull during night has left hole in surge pile.**



• Far Left: These Koehring tilting concrete mixers at the batching plant are the same ones that handled most of the concrete for Friant, Conchas and Dale Hollow Dams. They will handle much of the 2,100,000 yd. required by Bull Shoals.

• Left: Far below the trestle a 4-cu. yd. Blaw-Knox concrete bucket dumps its load of mix into a monolith. When workmen pour the last bucket of concrete, the dam will be a mass concrete structure, seven city blocks long, 283 feet high and 230 feet wide at the base. It will control a reservoir with a 940-mile shoreline.

days per year, although it will be used for a much longer time some years and in other years none at all. Except during large floods and prolonged dry periods, the lake levels resulting from regulation of stream flow will be favorable for boating and fishing.

Crest Length of 2,256 Feet

Bull Shoals Dam will have a total crest length of 2,256 feet, with a maximum height above stream bed of 283 feet. Its width at the base will be 230 feet. The sloping downstream face will taper in such fashion that the crest width will be only 26 feet. A roadway will run along the top of the dam—a 7-block trip.

The spillway, 808 feet long, will contain 17 gates, 40 x 28 ft. At a maximum flow depth of 34 feet over these gates, operators on the dam can bypass 230 million gpm. Deep down in the dam are 16 flood control conduits, situated at the base of the spillway section. These conduits each measure 4x9 ft. and have two gates, hydraulically operated from within the dam.

Water velocities will reach 80 miles an hour at the toe of the spillway, with speeds of 60 miles an hour inside the outlet conduits. The stilling basin is so intricately designed that the water will be slowed to seven miles an hour as it leaves that structure.

Eight 18-ft. diameter steel penstocks are being installed in the dam concrete. These penstocks, controlled by great 19x26 ft. gates, will ultimately serve the eight 13-ft. diameter turbines to be installed. These machines, rated at 70,000 kw at full power pool, will turn out 575 million kwh of electrical energy each year.

The dam will require 2,100,000 cu. yd. of concrete, 1,800,000 barrels of cement, 6,200,000 pounds of reinforcing steel, and over 10,000,000 pounds of other metals. An average number of 1,500 employees will work about 2,750,000 man-days to complete the new structure.

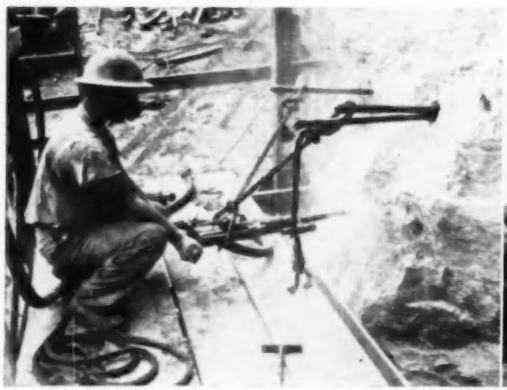
Search for Suitable Quarry

If Bull Shoals Dam consisted of nothing more than the rock quarry, it would still be a sizable undertaking. When concrete technicians searched the adjacent countryside, bent on finding a single deposit of limestone capable of building the dam, they were guided by only one rule: the ultimate quality of material. Terrain, distances, overburden and ground cover were conditions to be considered, but they were secondary. The quarry site selected is located in extremely rough terrain, and it will require a total of about four million cu. yd. of excavation to get out the two million cu. yd. of usable rock aggregate. The excess is overburden which has to be stripped.

Stripping is divided equally between that material which tractor equipment can move, and harder material which

• Jackhammer man works from a scaffold, drilling a bad piece of rock on right abutment.

• Hydraulic sluicing like this on left abutment cleans away stones up to 12 inches in diameter.



requires drilling, shooting and shovel loading. Some 750,000 cu. yd. of dirt stripping was sublet to M. E. Gillioz, a general contractor from Monett, Mo. Gillioz used a fleet of tractors and scrapers through the winter months of 1948-49 and by late Spring had his part of the dirt stocked in waste piles away from the quarry.

His equipment included three "C" Tournapulls, two Allis-Chalmers HD-14 tractors, a LeTourneau K-30 rooter, a LeTourneau "C" Tournadozer, a 20-yd. Gar Wood scraper, two 15-yd. Gar Wood scrapers, each pulled by Allis-Chalmers HD-19's, one Allis-Chalmers HD-14 with a Gar Wood dozer blade, two HD-19 tractors with Wooldridge pusher plates, and an HD-19-mounted Gar Wood dozer.

Clearing Difficult

One of the few consistent things about Gillioz' part of the stripping was its general difficulty. First of all, the land was covered with heavy brush and clumps of timber. Some of the trees were oak-tough, deep-rooted, mean to move. Approximately 80% of the trees were pushed over and piled by bull-dozers, but the remaining trees had to be sawed down and the stumps blown out by low velocity stump powder. The brush and trees were piled out on the side and burned.

Clay soil, loam, gravel and loose shale laid over most of the quarry site when Gillioz began moving the over-burden. It too was sporadic and uneven. In some places the equipment made deep 18-ft. cuts to get down to the bottom of ravines and fissures which cut down into the top of the limestone deposit. With an average 1-way haul of 850 feet, the equipment was forced to make each trip a bit

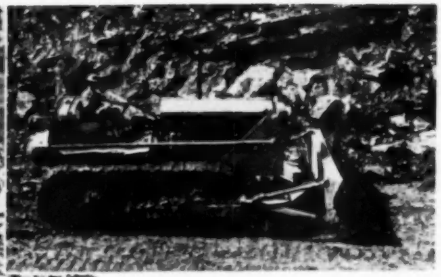
• Above: Drill operator handles bailer on one of the two Bucyrus-Erie 27-T churn drills working in stripping area. Holes are being drilled here in soft shale.

• Above Right: Blast Hole Drill Foreman H. L. "Red" Gilliland (left) and Wagon Drill Foreman C. E. Hilburn pause for a moment against a backdrop of Bucyrus-Erie 29-T churn drills. These rigs carry 9-in. bits on the end of 4,500-lb. tool strings.

• Right: In the stripping area, two 27-T's put down 7-inchers on a steep bank. These drills average five to six feet an hour.

• Below Left: Taking advantage of some usable material within the stripping area, 3½-yd. Lima 1201 shovel loads rock to Maxi-built side dump.

• Below Right: A 10-yd. Euclid, ordinarily used on stripping operations, occasionally picks up a load of good quality stone, dumps to 42-in. Allis-Chalmers gyratory crusher.



● Above: Caterpillar D-8 dozer pioneers haul roads ahead of stripping operations and cleans up around the 120-B.

● Left: This view looking down into the quarry pit shows the type of material being handled by the 5-yd. Bucyrus-Erie 120-B shovel.

different from the last to fit changing conditions.

Rooting with the LeTourneau K-30 rooter proved to be very effective, and sometimes it was possible to dig down several feet farther than had been anticipated by first ripping the formation with the single-tooth instrument. In some of the tougher rooting, Allis-Chalmers HD-19's, fore and aft, were necessary to force the rooter through the tough, shaly rock.

One Million Yd. Is Shovel Work

Approximately one million cu. yd. of tough stripping, composed primarily of rock excavation, is being handled by the main contractor, Flippin Materials Co. Practically all of this yardage is too tough to handle with tractor equipment, and much of it has to be blasted before a power shovel can move it to haul trucks.

Drilling equipment for this work consists of two Bucyrus-Erie 27-T blast hole drills, carrying 7-in. bits on the end of an approximate average 3,000-lb. tool string. These machines have proved highly efficient and economical in quarry stripping, because they put down a hole which holds much more powder than is possible with smaller drilling equipment conventionally used. The 27-T's average between five and six feet per hour, and are easy to move from hole to hole.

Cartridges of Hercules powder in the 5- or 6-in. by 26-lb. size are used to load these holes. Primacord detonating fuse sets off the charges, and the Primacord in turn is exploded by a common electric blasting cap and a hand blasting machine.

Broken shale and other soft stone which lies above the main limestone deposit is broken up in this way and made ready for the waste heap. A Lima 1201 diesel shovel with a 3½-cu. yd. dipper, is being used to load blasted rock. Hauling equipment under this shovel consists of four Euclid end dump trucks, capable of carrying 13½ cu. yd. per heaping load. With the short haul to the waste pile, these trucks keep pace adequately with the output of the Lima shovel.

Use 9-In. Blast Holes

Methods unique for northern Arkansas highlight the drilling in the quarry proper. Nine-in. diameter holes 83 feet deep reach down three feet below the quarry floor, are spotted to exact grid measurements. They are being punched down at an average rate of 4.8 feet per hour by three new electric-powered 29-T Bucyrus-Erie churn-type drills, which carry the big bits on the end of a tool string weighing 4,500 pounds. This heavy weight of tools means real penetrating-pulverizing-fracturing power as the motor delivers about 47 strokes per minute.

Considerable trouble in locating the quarry toe has sometimes resulted in the past, when column shooting broke some of the rock face back from the drilled holes. At the Bull Shoals quarry, Drill Boss "Red" Gilliland has devised a foolproof way of making certain his holes will always be exactly 27 feet back of each hole, and at right angles to the quarry face. They mark the spot by sinking in a short piece of

jackhammer steel. Then if the shot breaks out beyond the holes, their markers are always in place so that the 29-T's can resume work 27 feet back from the toe, regardless of the distance from the top face.

Drilling the limestone formation is somewhat tricky, due to seams and pockets of glacial clay. However, each machine has accounted for individual footages as high as 60 feet in an 8-hour shift, and the 4.8 foot per hour average is the figure for the first 25% of the job. Drill bits go down an average of 60 to 80 feet between sharpenings.

On the site is a small blacksmith shop equipped with an oil-fired furnace and a Bucyrus-Erie No. 12 bit sharpener. An interesting observation, made almost accidentally at the bit shop, increased drill bit life by nearly 75%. For some time the bits seemed to dull more easily than they should. One day a helper remarked, "They ought to. You're burning all your oxygen out of the tempering water, and you're not putting any back."

On the next batch of bits, fresh water was run in from a hose while the hot bits tempered. They lasted much longer. Now it is standard practice to temper the bits in cool running fresh water.

Blast holes are being drilled down about three feet into a sandstone ledge

Continued on page 56

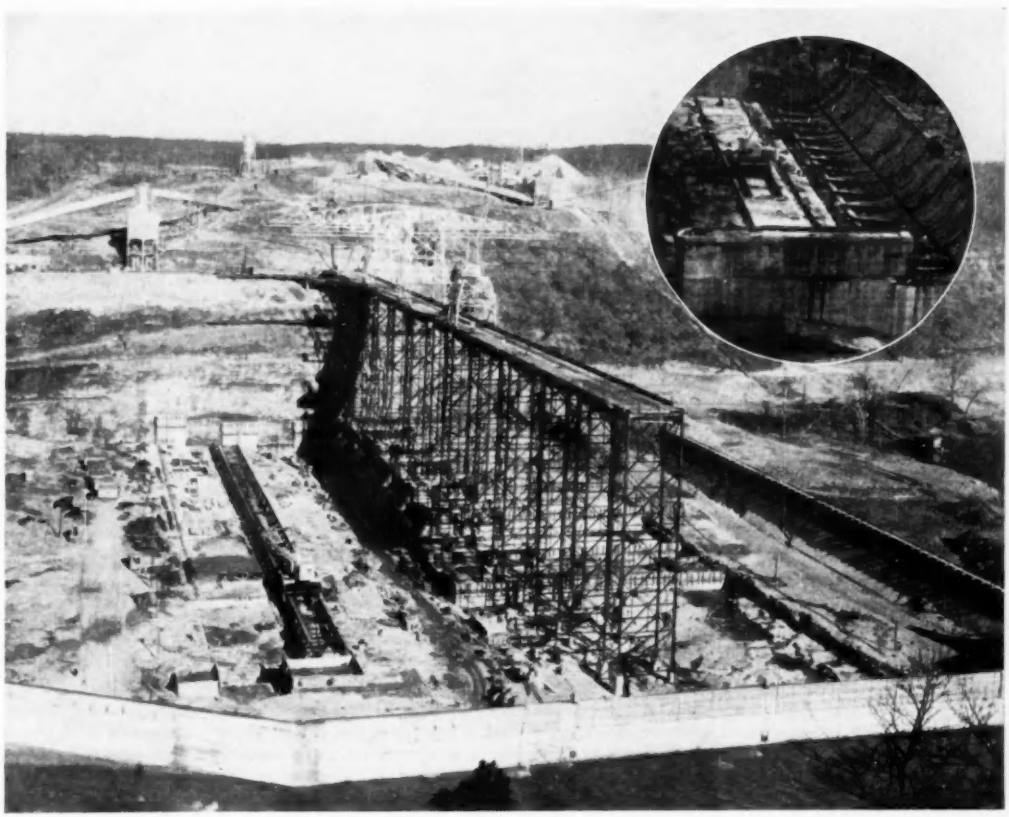
James P. Walsh

James P. Walsh, 52, vice-president of Harris-Walsh Construction Co., coal stripping firm of Scranton, Pa., died July 24 at Mercy Hospital, Scranton. Mr. Walsh had entered the hospital July 18 for observation.

A leader in the coal stripping industry, he was best known for his work as an operating manager. Mr. Walsh had been employed in various capacities by Timothy Burke, Inc., also coal strippers of Scranton, prior to his association with Harris-Walsh in 1941.

Born in Moosic, Pa., and a resident there at the time of his death, Mr. Walsh was a member of St. Mary's Church, Avoca; Board of Directors, Moosic Chamber of Commerce; Moosic Lions Club; Koch-Conley Post, American Legion, Scranton; Purple Club, Scranton, and the Friendly Sons of St. Patrick.

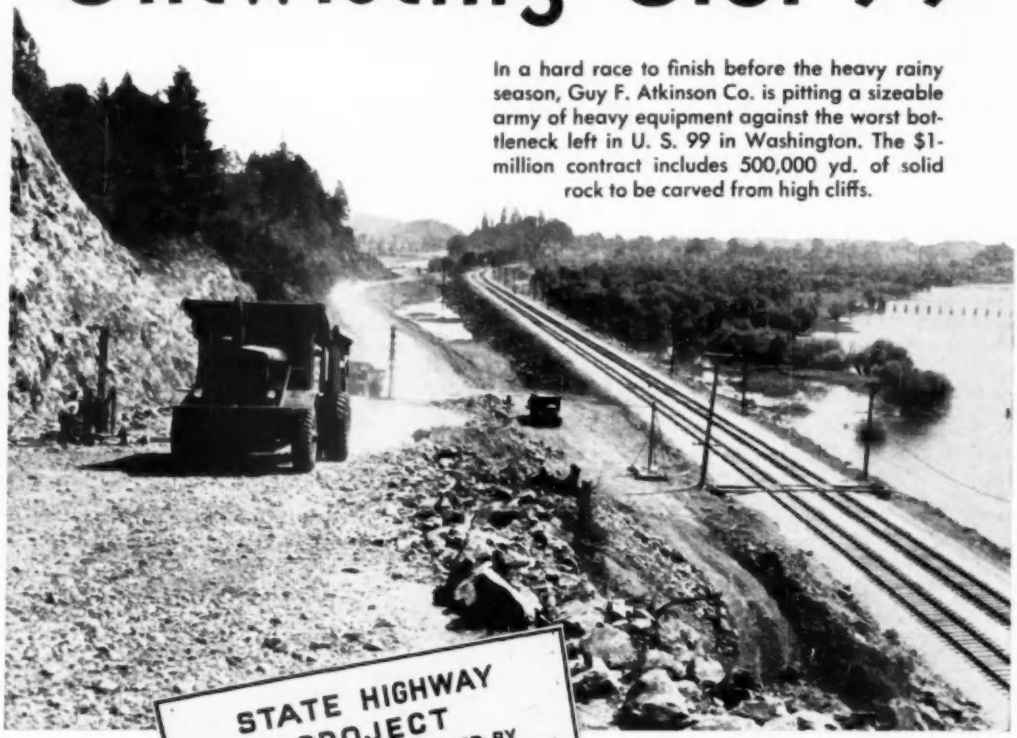
Surviving are his wife, Mary; a son, James, Jr.; two daughters, Mary Theresa and Catherine; and a brother, William Walsh, Harrison, N. J.



● Below: Concrete cofferdam in foreground encloses about 65% of the foundation area, was built because sheet piling was unavailable at the time the dam was started. In this picture the pouring trestle had just been erected; spillway apron slabs are not yet poured. ● Inset: Here the spillway apron slabs are finished and concrete blocks in the main dam are rising.

Untwisting U.S. 99

In a hard race to finish before the heavy rainy season, Guy F. Atkinson Co. is pitting a sizeable army of heavy equipment against the worst bottleneck left in U. S. 99 in Washington. The $1-million contract includes 500,000 yd. of solid rock to be carved from high cliffs.



• Three empty 17-yd. Euclid trucks rumble along haul roads on their way to two shovels on U. S. 99 relocation job. Ingersoll-Rand X-17 wagon drill (left) is one of six used to sink 2⅝-in. blast holes. Current for 5-yd. electric shovel on job is supplied at 2,300 volts through 1,000 feet of cable. Where cable crosses haul road, two 20-ft. towers on skids elevate line (center).

by Tom Riley

PROJECT Manager H. S. Booth looks up at the Washington sky and says they've had a good season so far. "They" are the 130 Guy F. Atkinson men who are speedily getting rid of steep grades and twisting curves along five miles of U. S. 99 by laying the way for a level superhighway between Portland, Ore., and Seattle, Wash. U. S. 99 is the main route—and for all practical purposes, the only one connecting the two cities.

The 5-mile relocation is on the Kalama-Kelso section in Washington, specifically from the Kalama River to the arterial highway to Longview—the worst bottleneck left in the road. The fast-moving Atkinson crew is working its way over swampy river land and through half a million yd. of solid rock—dead bent on polishing off the job by November, three months ahead of schedule.

Booth gives the company's reason for hurry: "This is rain country. We have here only a $1 million job, but we have placed a large quantity of equipment on it—most of the machines new. By doing so, we can expect to finish in November, missing the rainy season and its problems, and therefore we expect it (the high outlay in equipment) to pay."

The Washington State Highway Department awarded the contract to the San Francisco firm for $1,084,358 last March 1, giving a deadline of Feb. 23, 1950, the midst of the rainy season—top reason for Booth's desire to finish early. Partially sponsored by Federal Aid, the project includes all aspects of excavating and filling to grade for 255 stations, five miles of 4-lane highway. Gravel courses and paving, not yet opened to bid, will be for a 2-lane strip as had been done on other sections of the new road in this area. The remaining two lanes will not be paved until future traffic warrants it.

The history of this area brings out

its many possible complications. The region is known for a drizzly, 40-in. yearly rainfall. At this particular spot engineers wound the narrow old route of U. S. 99 over steep hills in a detour around Carrolls Point, a high promontory that overhangs the Columbia River. The Northern Pacific railroad utilizes all of the narrow passage below the cliffs. Straightening the old route was impractical—the new highway requires a half million yard cut alongside the railroad.

Kiewit Relocates Tracks

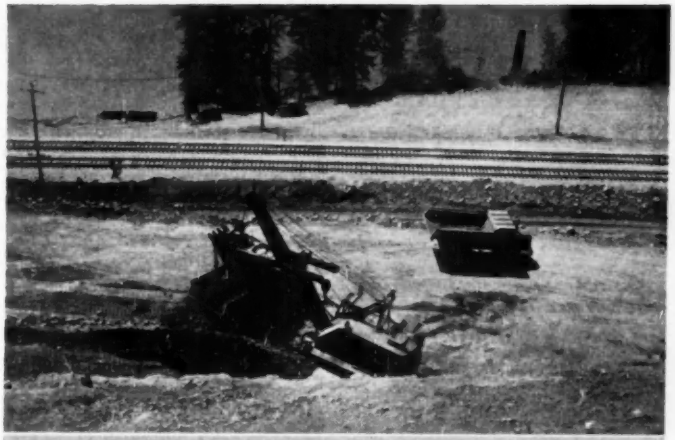
Last year Peter Kiewit Sons' Co., Kansas City, Mo., relocated the tracks—moving them a few feet, as far outward as possible toward the river. But the high cliffs still towered over the tracks—a ticklish proposition for any contractor taking the job of removing the rock from above. Kiewit also placed a short section of fill for the new road just north of the promontory. As both north and south of the point lies what might be called bottomless bottomland, Kiewit's fill cannot be graveled or paved—neither can the more extensive fills now being laid—until the material has settled for at least a year and a half. And the Columbia flowing alongside provides another problem to contractors working near it—regularly each spring it floods all the bottomland in the vicinity.

Atkinson started in March immediately after receiving the contract. As Assistant Project Manager E. B. Platt points out, the crew is well experienced for such a job—almost the entire personnel was on a tough 3½-mile relocation through rock on the North Santiam highway in Oregon, pushing that project through in the dry season of 1948. (*Excavating Engineer*, Aug., 1948, "Slugging Through Santiam Pass," p. 26.)

Clearing the right of way came first. Fifty-three acres were cleared (low-cutting stumps and brushing) at a contract price of $490 per acre. Twenty-six and a half acres were grubbed at $200 per acre. Forty men worked on this part of the job and three of five Caterpillar D-8 dozers on the project stacked trees and brush for burning.

Though brushing the steep sides of the point was the most difficult part—men hung on ropes part of the time—most of the job was in the wooded lowlands. Cottonwood trees are plentiful in the area—and they presented a problem because they were too soggy and wet to burn during the spring months. Atkinson solved this problem by obtaining a quantity of war-surplus "Goop," an incendiary paste or jelly used by the U. S. Army. The crews used this highly inflammable material to start fires in the piles of watersoaked wood and then, by throwing an old tire occasionally on the flames, managed to burn all the logs.

Stripping was non-existent as all fills are in the low pastureland where there is no bottom to the soft, alluvial soil. In fact, a foot of backwater from the Columbia was covering some of the right-of-way as late as July. On top of the Point some earth was removed to facilitate drilling—two D-8 dozers



• Above: A 2½-yd. Bucyrus-Erie 54-B shovel loads fluc on low ledge above tracks.

•Below Right: Old bridge crossing Kalama River is at south end of 5-mile project.

• Below: A 20-yd. Sterling Western truck dumps fill on northern part of project for leveling by Caterpillar D-8.

• A 2-mile fill will be laid along this stretch. Old borrow pit in foreground was used by Peter Kiewit Sons' Co. who relocated railroad tracks (far right beyond trees). Because of heavy cuts, Atkinson will need only about 50,000 yd. of borrow for this fill.

pushed the material over the cliffs. All initial pioneer roads were opened with the dozers. Working up on the cliff-sides was difficult and hazardous, but experienced dozer operators handled the machines without trouble.

Drilling and Blasting

Drilling and blasting crews moved right in beside the dozers on the big cut around Carrolls Point—key to the entire operation. Drilling Superintendent Carl Schmidt set up his compressed air in an interesting manner for a road project. Three large portable diesel compressors, a 500-cfm Gardner-Denver WBK 500-D and two 500-cfm Ingersoll-Rands—a KH500 and a 40-H-32025—were placed side by side on a central location at the top of the promontory. The compressor location was picked at a spot where the old highway curved close to the cliffs, making it easy to bring in fuel and supplies.

Coupled together through one 400-cu. ft. receiving tank, these three compressors are pumping air into 3,000 feet of 4-in. Armco Rainmaker steel pipe, a fairly light 18-gauge pipe with patented rubber ring connections. As this pipe parallels the entire top of the cliff and has a tapped outlet on every 20-ft. joint, the jackhammer and wagon drill men can connect in anywhere without the trouble of moving pipe or compressor. The setup was placed early—for use in pioneering as well as major drilling. One portable gas compressor, a 105-cfm Sullivan, was also brought in for miscellaneous use on pioneer roads.

Six Ingersoll-Rand X-71 wagon drills are sinking the major holes, using maximum points of 2⅝ inches with 1¼-in. round lug drill steel. Eight Gardner-Denver S-55 hand-helds supplement the wagon drills and are used for pioneering.

Drilling ran into a definite problem when the men started cutting down the cliffs. The rock, basically basalt, was found to be in strata of about 12 feet thick with intervening layers of conglomerates, clay and volcanic ash. The drill steel would jam and clog when it hit these layers.

Use Replaceable Bits

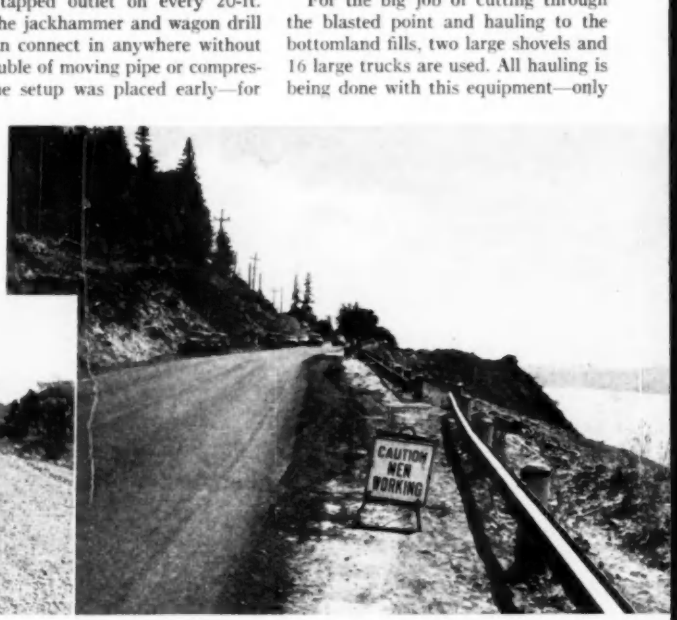
At first it was thought that carboloy-type bits would be best in the hard basalt, but standard Timken replaceable bits were found to be much less subject to jamming in the soft layers. They are being used throughout the operation. Considerable trouble with sticking is still encountered—a problem with no answer but to slug it out.

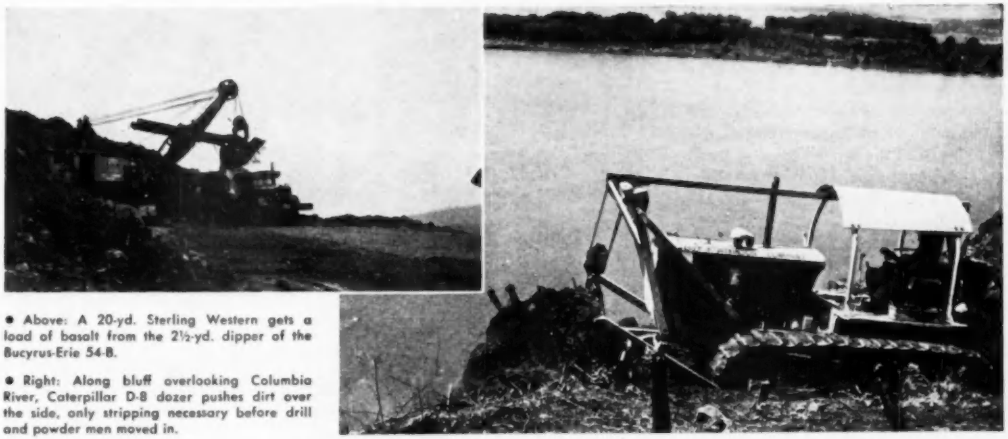
DuPont 40% stick and bag powder is being used for blasting. As the rock is a "diced" basalt, partially crystallized, it breaks up easily, seldom leaving any chunks too big for the shovels to handle.

For the big job of cutting through the blasted point and hauling to the bottomland fills, two large shovels and 16 large trucks are used. All hauling is being done with this equipment—only

• Right: Old highway 99 runs close to edge of cliff below which shovels are working. Because old road curved too close to the edge at this point, 800 feet of road had to be relocated, beginning at the end of fence just beyond sign.

• Below: A Caterpillar 12 motor grader patrols gravelled haul roads to and from fill area, making smooth going all the way for trucks.





• Above: A 20-yd. Sterling Western gets a load of basalt from the 2½-yd. dipper of the Bucyrus-Erie 54-B.

• Right: Along bluff overlooking Columbia River, Caterpillar D-8 dozer pushes dirt over the side, only stripping necessary before drill and powder men moved in.

other equipment on the job is five D-8 dozers used on the pioneer roads and on leveling the fills. A Caterpillar 12 motor grader is used for road maintenance.

The rock trucks include 10 new 17-yd. (with sideboards; 15-yd. without) Euclid 20-TD's. Two older 20-yd. Sterlings and four 20-yd. Westerns (a special Sterling model made up several years ago for Atkinson) complete the list. The shovels are a 2½-yd. Bucyrus-Erie 54-B and a new 5-yd. Bucyrus-Erie 120-B electric. The choice of an electric shovel on a road job was decided on because current was available and because of the efficiency of an electric drive in tough rock. Both shovels were transported to the site by rail, the 120-B on four freight cars to be assembled there for its first operation.

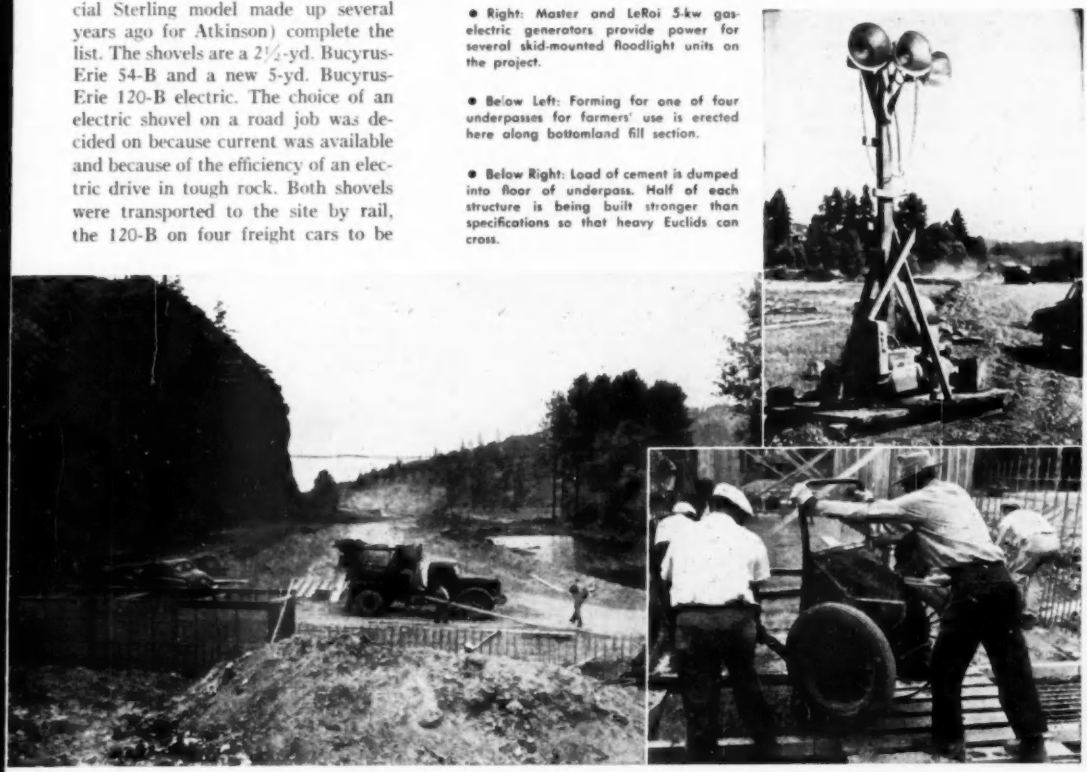
Right now the shovels are attacking the rocky promontory from both ends, the 54-B on the north, the 120-B on the south. Both are working up the face of the point on ledges or levels. The number of trucks served by each shovel varies with the changing length of the hauls, the 5-yd. machine usually loading 10 trucks, the 2½-yd., five or six.

By the time the shovels finish they will have removed 556,000 cu. yd. of solid rock from the face of Carrolls Point, plus 90,000 cu. yd. of common material. They are cutting down high banks which reach 120 to 160 feet

• Right: Master and LeRoi 5-kw gas-electric generators provide power for several skid-mounted floodlight units on the project.

• Below Left: Forming for one of four underpasses for farmers' use is erected here along bottomland fill section.

• Below Right: Load of cement is dumped into floor of underpass. Half of each structure is being built stronger than specifications so that heavy Euclids can cross.

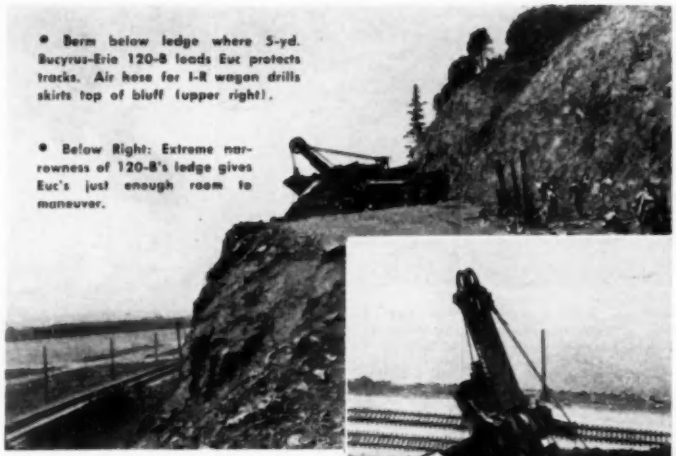


above the railroad and have a ground slope as steep as 1½:1. When finished, the slope of the entire promontory above the right of way will be ¼:1.

This one big cut is furnishing nearly all the material needed for the rest of the relocation, the 4-plus miles of bottomland fill. Approximately 50,000 yd. of additional solid rock material will be needed from borrow pits located near the south end of the project. As the big cut is approximately in the middle of the project, the riverbottom fills will extend approximately two miles to the south and to the north. The contract estimates 36 million station yards (100-ft. stations) of overhaul.

So far the electric shovel has been making its own pioneer road up the cliffside with practically no assistance. It operates on 1,000 feet of rubber-covered cable which supplies current at 2,300 volts. Pole connections spaced at 600-ft. intervals allow the 5-yd. machine to move anywhere along the 3,000-ft. cut. For the occasions when the cable must cross the haul roads, two 20-ft. high towers on skids are placed to elevate the line. Both the electric shovel and the single-axled Euclid trucks, though heavy rock equipment, have been able to maneuver along the narrow ledge.

The 54-B's ledge is not as precipitous and is wider than the 120-B's; the dual-axled Westerns and Sterlings load from it because maneuvering is easier.



• Berm below ledge where 5-yd. Bucyrus-Erie 120-B loads Euc protects tracks. Air hose for I-R wagon drills skirts top of bluff (upper right).

• Below Right: Extreme narrowness of 120-B's ledge gives Euc's just enough room to maneuver.

Atkinson considers the haul roads up to both shovels as having a lot to do with the fast loading. General Superintendent Wayne Wooten insists on good construction roads as the only way to maintain good haul time and to prevent tire and mechanical damage on the trucks.

Every road on the project resembles a boulevard, is kept well graveled, and is worked constantly by the grader. To a passerby the whole operation seems simple with the two smooth access roads leading up the cliffsides to the shovels. The trucks shuttle rapidly back and forth on the smooth, 76-ft. wide fills. The project seems somewhat deserted—the drilling and blasting crews are well scattered along the 3,000 feet of bluff and there are few men on the long fills—only a D-8 dozer operator and a spotter at each end. But this simplicity is a result of planning.

An ever constant bottleneck to even faster operations is the busy double railroad tracks that lie directly below the excavations. To prevent any damage to the rails, Atkinson has placed a 10-ft. high berm or dike of rock close alongside the inner track. This berm, approximately 3,000 feet long, stops the tumbling rocks loosened by the shovels and dozers. The ditch behind the berm is kept well cleaned out. As a further safeguard, two Northern Pacific flagmen are on duty during all working hours, on watch for the possi-

Continued on page 54

• Left: General Superintendent W. C. Wooten (center) talks over day's progress with Foremen James Forrest (left) who is in charge of pioneering and dozer work, and Bruce Shumway, who superintends shovel spread and trucks on north half of project.

• Below Left: Office and field shops are set up at north end of project. Trailer (left) is portable office especially designed with enough room for project manager, his assistant, paymaster and secretary.

• Below Right: Master Mechanic Ernie Ford, in charge of all maintenance, inspects truck-mounted welder.

Evolution of Ward-Leonard Control For Shovels and Draglines

Tracing electrical development of the three-motor electric machine through 47 years.

by P. S. Stevens
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SURPRISING as it may seem, Thomas Edison was undoubtedly influential in developing the first electric shovel we know about. Edison was successful in persuading Alexander Backus, president of the Vulcan Steam Shovel Co., Toledo, Ohio, to build the machine, which was shipped to the Milwaukee Railway and Light Co. on July 5, 1902. It was traction wheel mounted, had a boom-type front end and probably operated from a DC trolley circuit.

In the following 18 years—up to 1920—electric shovels were built with both AC and DC motors and rheostat control.

The first record of an AC machine of this type was a 4-yd. dipper dredge—very similar to a shovel—built in 1906. This machine had wound-rotor induction motors and was arranged to operate from a 2080-v, 3-phase, 25-cycle power supply. This dredge was shipped to H. R. H. Maharajah, Jammu and Kashmir, India, with two 18-in. hydraulic dredges.

It is interesting to note that even at this early date, engineers appreciated the necessity for forced ventilation of a motor which is frequently stalled as a normal part of the digging cycle. Also the advantages of lower flywheel effect resulting from the use of twin,

• **Top: First AC-motor excavator of the dipper type was this 4-yd. Bucyrus dipper dredge, "Himalaya," built in 1906 for the Maharajah of Jammu and Kashmir, India.**

• **Above: This 5-yd. Bucyrus 225-B which started work for the Hydro-Electric Power Co., Niagara Falls, Ont., in 1917 — was the first AC stripping shovel.**

• The first W-L equipped shovel—a 6-yd. Marion 300—started at Michigan Limestone & Chemical Co. in 1920.

• This 6-yd. Bucyrus W-L 225-B, went to M. A. Hanna Co. later the same year, is still at work.

• Foley Brothers' 7-yd. Bucyrus 175-B—the first completely shunt motor equipped shovel—appeared in 1925.

half-sized hoist motors—a common practice today on larger machines—was appreciated at that time.

Prior to 1920 there existed in the electric shovel industry a battle between alternating and direct currents, very much the same as existed on the question of railroad electrification. Since most power s ıpply was alternating current, the DC motor shovel required a motor-generator set. The AC shovel usually was driven by 440-v motors with transformers on board to step down from 4,000 to 2,300 volts.

Today the 3-motor shovel is offered in sizes of two cu. yd. and larger. Four cu. yd. and smaller shovels are available also as friction-type machines driven by diesel or gasoline engines or single electric motors. Draglines with variable-speed motors on the several motions are available in 2½-cu. yd. and larger sizes, and in sizes 10 cu. yd. and smaller are available with diesel drive. The smaller sizes are sold with gasoline engines and single electric motors.

Meaning of "Ward-Leonard"

The term "Ward-Leonard" in the shovel industry refers to a DC motor driven by its own individual generator, whereby the torque and speed of the motor and rotational direction are determined by controlling the field of the generator. Sometimes referred to as a "variable-voltage control," it offers as a principle advantage a more effective and permanently adjusted means of causing the motor to stall down and continue to pull at a predetermined maximum torque without interrupting the circuit.

The steam engine had accomplished this result in a most excellent manner due to its limited boiler pressure. With the earlier rheostat control using both alternating and direct current, the stalling torque was limited, after a fashion, by using "notch back" or "jamming" relays. Such devices were not fully reliable, however, on account of wear and tear, and lack of understanding on the part of operating personnel in the early days of electric shovels.

With the Ward-Leonard control, the stalling torque limitation was obtained by using a differential series field on the generator. It gave to the electric motor the steam engine characteristics in a foolproof fashion, and with means which would remain reasonably permanent in adjustment. Drooping voltage with increasing current obtained with the differential compound generators used caused the shovel motor to stall down and still continue to pull hard without abusing itself or the mechanical parts of the shovel.

First W-L Machines in 1920

The first Ward-Leonard electric shovels were put into operation in 1920. These were equipped with series motors, a carryover from rheostat control. While the series motor is an excellent tool for digging and hoisting, it is not so effective for braking operation or lowering the dipper.

However, after considerable experimenting, the series motor was made to lower the dipper reasonably well, and in spite of its shortcomings, some of the original Ward-Leonard series motor machines are still in operation. One of the shovels shipped in 1920 began its life on the Iron Range in northern Minnesota and is now in operation in a coal mine in Ohio. This series-motor equipped machine is still doing a creditable job.

The next important development had to do with the generator. The original shovel generator was made with two fields, one separately excited shunt-type field which was varied for motor speed control, and a differential series field with a fixed number of turns. The usual commutating fields were used. The objection to this characteristic was that when the motor began to pull hard, the voltage of the generator was

too low and the digging speed entirely too slow. The corresponding steam shovels would dig much faster.

The problem was put up to the generator designer, who solved it by adding a third field—a self-excited shunt field which raised the voltage characteristic effectively especially at operating loads. This change gave the shovel the well known "3-field generator." The improvement appeared in 1920.

The first Ward-Leonard shovel had a no-load generator voltage of about 330 applied to a 230-v motor. The self-excited field increased the no-load voltage to about 400. Over the years, generator and motor designs have improved so that no-load voltages of 575 are common in shovel equipment. This has resulted in faster operating speeds without increased size of motors.

In the shovel industry, we use for Ward-Leonard equipment specification purposes, the continuous hp rating of the motor at 230-v. Actually, in service the generators develop approximately 460-v at the motor continuous current. Hence, if anyone attempts to compare the hp of a Ward-Leonard shovel with a diesel-driven shovel, for example, he should increase the electric motor continuous rated hp by 100%. The same increase must be made before comparing with similar applications of AC motors to shovels and dredges.

Objections to Series Motor

Referring again to the series wound motors and analyzing the characteristics bring out several objections. The heavy armature circuits had to be opened for reversing, and this required large contactors. The control when

Mr. Steven's article is based on his paper presented before the American Institute of Electrical Engineers. The paper was printed originally in "AIEE Transactions."

plugging (lowering) the dipper was rough on commutators.

To accomplish reasonable operation required a variable generator differential field, armature resistors, armature contactors, and generator self-excited field contactors to insure reduced generator voltage before opening the armature circuit. The operation timing of these devices was determined by rotation direction switches on the machinery shafts. The result was a considerable layout of what would be termed today "gadgets."

In shovel operation, with its relatively short cycles, lowering, braking, and deceleration rank closer in importance to acceleration and pulling than in many other applications. Hence, attention was turned to the shunt motor which can hold back as readily as it can pull.

A shunt-type motor with a separately excited field has not as much peak torque per ampere as a series motor. However, the proper size of motor to drive a shovel motion is not determined by the motor's peak capacity. Rather, it is determined by its continuous load-carrying thermal capacity.

Shovel motors in most cases are force ventilated to improve the con-

• An example of a modern Ward-Leonard equipped shovel is this 5-yd. machine shown loading limestone in a Missouri quarry.

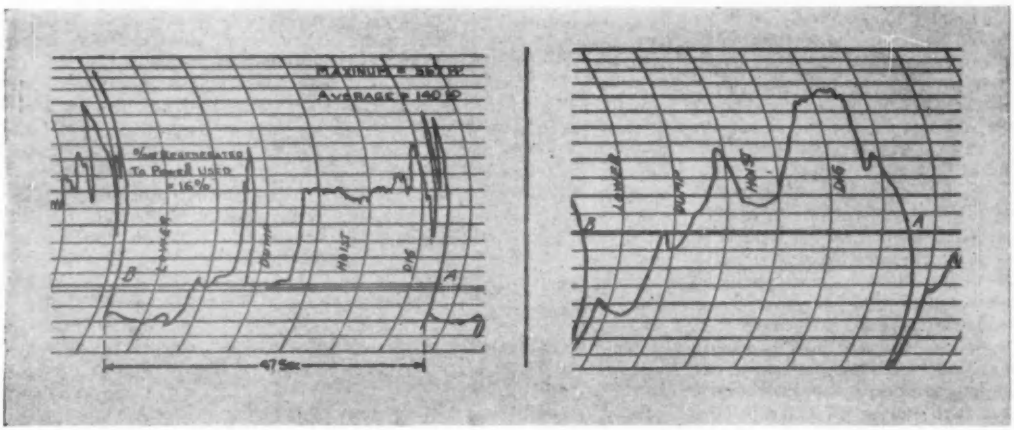
tinuous rating, and with such have more than ample peak or stall capacity with separately excited fields. Hence, the separately excited or shunt-type motor offered excellent possibilities for simplifying shovel control as well as greatly improving operating characteristics.

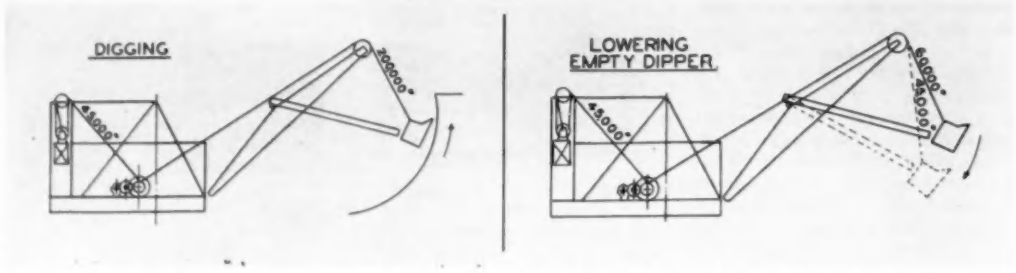
With the separately excited motor, reverse rotation is obtained by reversing the generator separately excited field. Negative torques are handled just as readily as positive torques and without gadgets. High-speed empty dipper lowering is accomplished by raising the generator voltage to a maximum, and weakening the motor field somewhat.

Plugging for stopping is smooth and

• Below Left: Regeneration took place in the pioneer motor lowering AC shovels. Input peaks were reached and dropped very quickly.

• Below: Similar diagram of kw input to hoist with motor lowering in a W-L shovel shows more regeneration. Peaks are reached gradually—more desirable power load.





• Balanced hoist—shown here schematically for a 20-yd. shovel—utilizes live counterweight (does not add to total weight of machine) to permit use of smaller-sized motors to do the same work as larger motors in a non-balanced hoist shovel.

trouble-free. Control became simplicity in the extreme. Motor and generator armatures were connected solidly with no resistors, contactors, or knife switches.

The first completely shunt motor equipped shovel was a 7-yd. machine installed in a strip mine in Montana in 1925. Advantages of the shunt motor were realized immediately by operating people as well as designers and while for several years there were still arguments between series motor and shunt motor advocates, in 1928 the shunt motor became universal.

The considerable regeneration of power when lowering the dipper or stopping the swing motion was sufficient to require a 15 to 20% downward revision of kwh per cu. yd. excavated. A modern large electric stripping shovel equipped with balanced hoist (which will be discussed later) will dig and move a cu. yd. for 0.3 kwh. Draglines are not so efficient as will be pointed out later.

Dipper Lowering Problems

It was the practice with early railroad-type steam shovels to lower the dipper by declutching the engine and catching the falling dipper on a mechanical foot-operated brake. On larger steam stripping shovels appearing later, it was the practice to back the dipper down part way on the engine using a release throttle and then after nearing the digging position throw out the clutch and lower the remaining distance on the brake.

The first AC stripping shovels, 6 to 8 cu. yd., put into operation in 1917, accomplished the complete lowering cycle of the empty dipper by means of the motors. Hoist machinery, however, was equipped with clutches and brakes as for steam operation. The early rheostatic DC stripping shovels lowered somewhat after the fashion of the steam shovel, part way on the motor and part way on the brake. At that time all smaller electric shovels lowered completely on the brake.

Up to 1925, no attempt had been made to lower the dipper of a close-coupled fast-cycle shovel on the motor. However, Ward-Leonard control with the shunt motor offered new possibilities. Heretofore, all electric shovels were in reality electrified steam shovels.

The first real electric shovel was designed in 1925, and the hoist machinery was equipped with only a small disconnecting clutch so the motor could be used for propelling. It was not equipped with a large size brake suitable for lowering the dipper—the design contemplated motor lowering. This was the first 4-yd. full revolving shovel which replaced the old heavy-duty fast-cycle railroad-type shovel common in this country.

The first demonstration of this shovel was disappointing to many who viewed it because the motor lowering was so smooth it appeared slow. It was not so spectacular as dropping the dipper and catching it on a brake. The opponents lost account of the fact that often the brake lowered dipper would be carried in a high position during a considerable portion of the return swinging cycle, and then dropped fast to make up for lost time.

With motor lowering it was only necessary to begin the lowering stroke immediately after dumping the load into the car. Even at reduced top speed, compared with gravity fall, the dipper would be down as fast as the swing was over to the digging position.

Motor lowering is much easier on the operator because he accomplishes the complete hoisting and lowering operation with the controller handle, and he is relieved of foot brake and clutch operation. It is also easier on the machinery, hoist rope and entire shovel. Even on the smallest Ward-Leonard shovels, motor lowering is practically universal today.

Shunt motor Ward-Leonard control was such an improvement in permitting fast and smooth plugging that it focused attention on the fact that the shovel cycle could be improved if motors with reduced flywheel effect were available. In the early days, electric shovels were properly classed as slow in comparison with steam shovels, because it required too much time to accelerate and decelerate the motor armature. The steam engine accelerated to speed almost instantly.

The first hoist motor on the newly developed 4-yd. electric shovel of 1925 had a WR^2 (inertia factor) of 1,040 pound-feet squared. It could make four cycles per minute hoisting and lowering the empty dipper which is a good measure of the effectiveness of motor lowering. The first model of a new line of motor developed shortly thereafter had a WR^2 of 437, and permitted five cycles per minute of the hoist motion.

The normal complete cycle of such a shovel including digging, swinging, dumping, and return is three cycles per minute in good digging. In rock the speed is two cycles per minute. Several new motors have been developed over the years, each smaller physically than its predecessor—a valuable improvement for a compact shovel layout. A typical result is the growth of 1925's 4-yd. capacity shovel into the 5-yd. shovel of today with no corresponding increase in machinery size.

Introduce Live Counterweight

The next major improvement made in electric shovels and closely related with shunt motor Ward-Leonard control was the balanced hoist used for the first time in 1930 on a 16-yd. stripping

shovel. The separately excited motor having the characteristic of continuing to run at about the same speed even if the torque load is reversed from negative to positive permits the effective use of a movable counterweight to help hoist the dipper.

Such shovels have heavy ballast at the rear for stability and to use some of this ballast as live counterweight does not add to the total weight of the machine. The advantages of counterweights are well known in elevators and hoists. A counterweight permits the use of a smaller size motor to do the same work and greatly improves the safety condition in case of power or brake failure. On a shovel, however, there are other advantages not found in the elevator or hoist.

For example, in the "lowering" section of the accompanying diagram, the balancing point between empty dipper and live counterweight occurs when the bail pull reduces to 45,000 pounds. It is easily understood how the bail pull reduces as the dipper lowers, because when the dipper handle reaches a vertical position, the pull on the hoist rope is zero as the entire dipper and handle weight is then supported by the shipper shaft.

This means that below the balancing point, the hoist motors must lift the counterweight to permit the dipper to continue in its lowering direction. Tracing through the lowering operation, the hoist motor controller handle is thrown into reverse direction after dumping, and there is an input kick-off, during which period the motors are motoring to accelerate themselves until the weight of the falling dipper overhauls them and the motors begin to regenerate and hold back.

Improves Operating Charcteristics

The effect of the falling dipper weight is high at the beginning of the stroke, and combined with the electric power input, accelerate the motors quickly. At the bottom portion of the lowering stroke, the bail pull is reduced to such an extent that the effect of the counterweight is then used in addition to electric power to stop the motors. The controller handle is thrown into the hoisting direction before the dipper reaches the bottom of the stroke.

The result is that the counterweight and electric power stop the motors quickly at the bottom and accelerate them again into the hoisting direction. The effect of this is just as if a subway train were permitted to run downhill when leaving a station during acceleration in order to reach a high speed quickly, and then run uphill during deceleration to stop quickly at the next station.

The reduction in both motor size and power demand with the counterweight are self-evident. Also the kilowatts drawn from the line are less and the kilowatts pumped back into the line are less, because the counterweight has the effect of reducing both. The spread between positive and negative power peaks is reduced.

There is still another advantage of the counterweight in connection with electric power use. This comes about from the fact that some power companies that have shovels and draglines on their lines install, the author thinks unfairly, ratchets on their kwh meters. During periods of regeneration, of course, the shovel tends to drive the kwh meter backward causing it to unwind some of the power recorded previously. Ratchets prevent this.

Large coal stripping shovels operate three shifts per day whereas coal is usually loaded out of the mine during only one shift. During the day shift, of course, there is enough other load on the line inside the meter to absorb the regenerated power from the stripping shovel. But during the night shifts this is not usually the case.

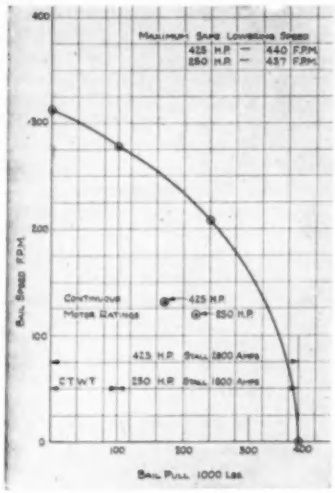
Power Consumption Is Less

Hence, the energy shown by the kwh meter for large stripping shovels, with or without counterweight, is greater than the energy actually used on a net basis. The difference between actual and recorded energy is less with a balanced hoist shovel, because the balanced hoist stores up a certain amount of energy during lowering of the dipper and gives it up during digging. This is another reason why a balanced hoist shovel has a lower power bill, and is in addition to the fact that its motors—being smaller to begin with—use less power.

Another advantage is faster acceleration resulting from smaller motors. A comparison of flywheel energy of motor armatures typical of those used on 35- and 40-yd. shovels of today is helpful

● Above: Closeup rear view shows hoist arrangement.

● Left: A modern 33-yd. shovel with balanced hoist strips coal in Illinois.



Hoist Motor Ratings

Motor Frame	Horse-power Con-tinuous	WR^2	Con-tinuous Rating Rpm	Maxi-mum Safe, Rpm	WR^2X Con-tinuous Rpm^2	WR^2X Maxi-mum Rpm^2
422	425	1,800	375	1,250	$253 X10^6$	$2,820X10^6$
420	250	800	400	1,400	$128 X10^6$	$1,578X10^6$
618	250	580	410	1,500	$97.5X10^6$	$1,300X10^6$

Comparison of Shovel Dipper Power With and Without Balanced Hoist

Motors	2 425-hp Without Balanced Hoist	2 250-hp With Balanced Hoist
Stalling Bail Pull, Pounds		
By Motors	375,000	275,000
By Counterweight		100,000
Total	375,000	375,000
Maximum Safe Lowering Speed		
Motor—rpm	1,250	1,500
Dipper bail—fpm	440	437
Continuous Motor Rating Bail Pull, Pounds		
By motors	171,000	119,700
By counterweight		100,000
Total	171,000	219,700

in demonstrating these factors. For example, a 425-hp motor is used without a counterweight, and a 250-hp motor with a counterweight, two of each driving the hoist motion.

The 250-hp motor shows a considerable advantage in flywheel effect. A new 250-hp motor available today makes a still greater reduction possible. This explains why shovel runners notice that the smaller motors start and stop quicker, resulting in a faster digging cycle.

A comparison of bail-pull and bail-speed figures of two 425-hp motors without balanced hoist and two 250-hp motors with balanced hoist shows that the two can be made to do the same work. Further, the smaller motors have the advantage of faster acceleration, reduced power consumption, and reduced heating. The continuous rating of the 425-hp motor without balanced hoist occurs at a lower bail pull than

• Left and Above: Speed-pull curve and rating tables for large shovel hoist compare use of large motors without and small motors with balanced hoist. The continuous rating of the 425-hp motor is at a lower bail pull than is that of the smaller motor with balanced hoist (i.e., a greater percentage of the cycle with the large motor exceeds the continuous rating).

in the case of the smaller motor. That is to say, a greater percentage of the cycle with the large motor exceeds the continuous rating.

While it is true that the counterweight carries a rope maintenance item, estimates show that this is less than the cost of extra power with the larger motors. The balanced hoist is available only on large stripping shovels. Smaller quarry and mining type machines do not have enough space to permit such an installation.

W-L Applied to Draglines

The advantages of Ward-Leonard control are not confined to the shovel. They are also effective on the dragline excavator. Draglines have the advantage of longer reach and have in recent years become very popular for coal stripping where properties with shallow overburden are becoming scarcer. Deeper stripping is being considered today in the order of 75 feet or more cover above a vein of coal.

As draglines become larger, the conventional method of handling the bucket by driving the drag and hoist drums with one motor and using clutches and brakes becomes more of a problem.

During 1942, the first dragline with individual motors on the drag and hoist drums was put into operation with a 25-cu. yd. bucket in an Illinois coal strip mine. This eliminated the need for using brakes and clutches, and while such a drive is quite expensive, the benefits are so great that the trend has now spread to smaller machines, even down to the 8-yd. size.

Large draglines are widely used in the anthracite field where there is much rock digging and such draglines perform exceptionally well in this service. Years ago a dragline was not considered a good rock digging tool, but Ward-Leonard control and individual motor drive helped make these large machines economical in rock work.

Modern Large Dragline

Machines of this type now handle 25-cu. yd. buckets on 180-ft. booms and swing on a 34-ft. diameter roller circle. Such a machine, of course, is shipped knocked down and consists of 47 freight carloads. The working weight is approximately 2,500,000 pounds including 275,000 pounds of ballast in the rear of the revolving frame. It is equipped with walking-traction mounting instead of crawlers as commonly used on shovels. It is driven by two motor-generator sets and DC motors.

A dragline of this size will draw peak loads of 2,600 kw and pump back to the line peaks of about 1300 kw. The energy consumption, in kwh per cu. yd. excavated is 50 to 75% greater than that of large shovels equipped with balanced hoists. The dragline usually moves material farther and lifts it higher than the shovel, and considerably more electric equipment with attendant losses is required for the dragline to handle the same yardage.

The dragline does not lend itself well to the benefits of a live counterweight. On a shovel, one motion digs and hoists and one counterweight assists both operations, whereas on the dragline, two counterweights would be required with resulting complication.

Furthermore, dragline ropes travel farther than shovel ropes so that either excessively high counterweight towers would be required, or one must accept higher friction losses and counterweight rope wear by using more parts of line and more sheaves with short towers.

An alternate power peak absorbing arrangement, as used in large steel mill drives and mine hoists consisting of flywheels in motor-generator sets, has not yet seemed justified.

Early Ward-Leonard equipment experienced an excess of bail pull and

motor torque when starting up cold in wintertime. This came about because at low temperatures, field resistances were low and excitation above normal on the exciter, generator, and motor. After equipment had been running for several hours and was up to temperature, motor torques would become normal.

Temperature Compensation Required

In northern climates, this differential was a considerable item. Combined with it was the fact that most steels are weaker at low temperatures, and should not be subjected to higher than normal stresses. In some localities, greater than normal dipper handle maintenance was experienced in the wintertime.

This problem was well considered by operators, shovel manufacturers, and electric equipment manufacturers, and today equipment is provided with special characteristics which maintain approximately the same motor torques at various temperatures. For example, starting up on a cold morning, exciter voltages are below the normal of 125 v.

One scheme of accomplishing this result is to use a high resistance differential shunt field in the constant voltage exciter. Another scheme is to use thermal magnetic shunts between the main pole tips to the constant voltage exciter. Both schemes are effective.

Add Rotating Control

Large draglines and shovels are equipped today with what may generally be termed "rotating control" in connection with the Ward-Leonard application. Commonly used in excavators are the General Electric Company "Amplidyne" and the Westinghouse Electric Corporation "Rototrol." Rotating control adds a variable voltage exciter—in fact, a small motor-generator set—to each of the hoist, swing and crowd motions in addition to the constant voltage exciter, which is common to all motions.

These rotating control units replace the bulk of the contactors and part of the field resistors required with the magnetic-type control used on smaller machines. Rotating control produces a faster response of the generators to the needs of the operator for quick changes in power, with the result of an appreciable gain in output. The advantages, however, do not seem to justify the extra cost on shovels smaller than five or six cu. yd. and draglines smaller than eight cu. yd.

A Look to the Future

Although forecasting future trends is a dangerous pastime, there does not seem to be any other scheme of power transmission on the horizon which is as well suited to the requirements of shovel and dragline operation as the modern Ward-Leonard electric control. The nearest approach today is the hydraulic transmission with variable stroke pumps. The "Oilgear" is a good example. However, such equipment is not yet developed in large enough units, and even in small sizes available today, it is still too costly—in comparison with Ward-Leonard equipment—to be used commercially on shovels.

High pressure steam and enclosed circuit compressed air systems have been proposed, but the shovel industry has not been large enough to carry on such pioneering work itself. The trends in locomotive development include electric transmission with steam and gas turbine drives as well as diesel engines. Hence, the shovel industry does not expect much help from this quarter as far as transmission of power from a constantly rotating prime mover to the shovel dipper is concerned.

Developments to Come

For contracting work, the clutch-type machine driven by internal combustion engine is preferred because of its independence of power lines. No doubt, when higher-speed, more compact diesel engines are available, diesel drive will be used on larger machines, combined probably with Ward-Leonard transmissions.

The friction-driven machine is gaining ground in the smaller sizes, as evidenced by the fact that before 1930 Ward-Leonard electric shovels were sold in sizes as small as 1½-cu. yd. capacity, whereas today there are very few machines sold smaller than 2½ cu. yd.

It seems quite certain that any form of power transmission which is to replace the Ward-Leonard drive for large machines in the future must provide for power braking. It has been a great relief to both user and manufacturer to be free of the problems connected with large heavy-duty mechanical brakes and clutches. Ward-Leonard control with its regenerative braking characteristic has done the job so well that it seems to be safely entrenched for some years to come.

• Left: Modern 25-yd. dragline, shown stripping iron ore in Minnesota and loading the belt conveyor through mobile hopper, has rotating type W-L control, two M-G sets 1,250- and 500-hp, and seven DC motors, 425- and 125-hp.
• Below: 1942 saw the first dragline with individual hoist and drag motors—a Marion 7800 at Northern Illinois Coal Co.

Seven More Miles

WEST — to —

• 1. Forms are being placed and ground prepared for paving two lanes on the north side of existing pavement in Lafayette. 2. A Multi-Foote 34-E Duomix places concrete for paving operations in Lafayette. 3. This Jaeger finisher smooths concrete placed by the 34-E. 4. This view shows part of the south roadway on which blanket course has been laid. 5. An Allis-Chalmers HD-7 tractor with Gar Wood hydraulic bulldozer spreads blanket course material.

One of numerous Ohio roadbuilding projects is the superhighway extension now being constructed on the National Highway about 15 miles west of Columbus. W. H. Ringwald and Sons Co., Inc., of Chillicothe holds the prime contract.

MOTORISTS approaching Columbus, Ohio, from the west on U. S. Route 40 will enjoy the driving benefits of seven additional miles of superhighway when the project now in progress between Lafayette and West Jefferson is completed at the end of this year. The $937,000 contract, on which major work began in April, provides for a westward extension of the 4-lane western approach to the Ohio capital where the highway presently narrows to two lanes 15 miles out.

In general, the project involves adding two new 12-ft. lanes of concrete road to the existing two lanes with the old and new strips to be divided by a medial parkway; there are also short sections where additions to the present road will be made on both sides. The work of constructing the new strip includes something like 85,000 yd. of excavation for roadway, borrow and structures; about 100,000 sq. yd. of portland cement and asphaltic concrete pavement, the construction of an 80-ft. extension of a 21-ft. span bridge, and a number of concrete box and flat-top culverts.

The prime contract for the project was awarded to W. H. Ringwald and Sons Co., Chillicothe, Ohio, last October on a low bid of $936,965.92. Pavement work accounts for approximately 50% of the total, roadway preparation for 44%, and structures for the remaining 6%. The work is under the supervision of the Ohio State Department of Highways and is identified as Project No. 473.

The Ringwald firm is handling all of the portland cement pavement work plus the roadway and borrow excavation. The rest of the work has been let under subcontract arrangement as follows: asphaltic concrete paving went to Andy Burns Construction Co., Columbus; drainage work, including storm sewers, catch basins, manholes, etc., to Haddad Construction Co., Columbus; and all structures will be built by George A. Stein and Sons, Chillicothe.

The project is divided into three separate sections. The westernmost of these is identified as Section D2 and consists of 1,000 lineal feet of work in the Village of Lafayette. Here double-lane concrete strips are being installed on both sides of the existing 2-lane strips, which in turn will be asphalted.

Just adjacent and extending eastward five miles is Section C. This includes 1,300 lineal feet of work similar to that of Section D2 plus some 27,500 lineal feet of double-lane concrete which will be separated from the present highway by a medial parkway.

The remaining part (Section B) covers 1½ miles and extends into the City of West Jefferson, the present western terminus of the superhighway to Columbus. This section includes 4,200 feet of double-lane concrete, then 1,000 feet of 4-lane, another 1,000 feet of 2-lane, and 1,200 feet of widening on the north and south sides of the existing pavement.

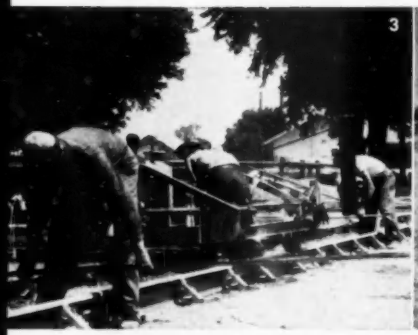
Full Scale Operations Begin in Spring

While full scale operations on the project did not begin until Spring, the Haddad firm did some of the subcontracted drainage work during the winter months. This work consisted primarily of digging storm sewers and ditches for placement of clay tiles for road drainage. A ¾-yd. Northwest shovel handled the excavating.

Major work on the rest of the project was begun April 1, starting with the widening operation (Section D2) in Lafayette. A ¾-yd. Byers 83 diesel

# of Superhighway

EAST



shovel was used to excavate on both sides of the center strip. The dirt was loaded to trucks which dumped some of the dirt to a small fill area just east of Lafayette and to another larger fill 2½ miles farther on.

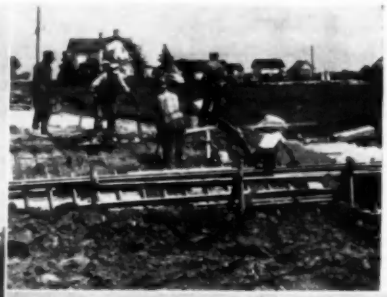
From here excavating operations moved eastward and by the time the writer visited the project, about ⅓ of the total 73,090 cu. yd. of roadway excavating had been completed. Almost all of the digging is to shallow depths only—there are no large cuts and only two fills of any appreciable size. One of these is an 11,000-yd. fill in Section C, about 2½ miles east of the start of operations. The other is in section B near West Jefferson, and amounts to roughly 10,000 cu. yd. Much of the material for these fills is being obtained from the roadway itself, although a total of 10,000 yd. additional is being obtained from nearby borrow areas.

When the project was visited, the easternmost zone of activity centered around installation of the 80-ft. extension of a bridge, under the two south lanes being added at that point. It is the single structure on the project with greater than 20-ft. span. The work on this structure is part of the Stein subcontract.

Installation of the bridge extension involved only 408 cu. yd. of unclassified excavation and 164 cu. yd. of channel digging, both of which had been handled by a Bucyrus-Erie 22-B crane equipped with a 45-ft. boom and ¾-yd. clamshell bucket. When the job was visited, the excavating had been completed and the 22-B was being used to place concrete for the extension structure. The crane spotted transit-

• 6. Roadway for the south side strip is graded by a Galion 116 patrol grader. 7. Trench for placing of 6-in. drainage tiles is excavated by a Buckeye 120 traction ditcher.

• 8. A ¾-yd. diesel shovel—a Byers 83—handled most of the shovel excavation on the roadway. 9. An International TD-18 tractor and a 10-cu. yd. Heil scraper team up to rough grade part of the roadway.



• Far Left: This ¾-yd. Bucyrus-Erie 22-B clamshell excavated for 80-ft. bridge extension—only large structure on project.

• Left: Workmen spread concrete in forms on the bridge extension structure. Ringwald field office is established in farmhouse in background.

• Below: Operating as a crane, 22-B swings 1-yd. loads of concrete from transit mixer at right to structure.

mixed concrete in a 1-yd. bucket for workers on the structure. A 75-cfm Jaeger air compressor was supplying power for the concrete vibrators being used.

By way of description, the bridge is a reinforced concrete structure with a semi-circular culvert barrel which extends 11½ feet above the flow line at its highest point. The span measures 21 feet. For building this extension of the existing bridge, specifications called for 207 cu. yd. of Class C concrete for the culvert barrel, 118 cu. yd. of Class E concrete for footings, 13,920 pounds of reinforcing steel, and 48 sq. yd. of waterproofing.

Backfilling and Compaction at Bridge

As work on the structure progressed, an Allis-Chalmers HD-10 tractor with a Gar Wood hydraulic bulldozer and Ingram 1146-W tandem sheepsfoot roller backfilled and compacted around completed portions of the extension.

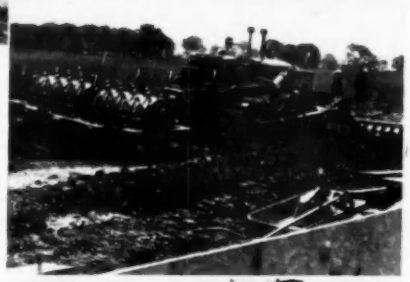
At a point about 300 yards west of the bridge, a 10-cu. yd. Heil scraper, drawn by an International TD-18 tractor with Bucyrus-Erie hydraulic Bullgrader attachment, was being used to rough grade the roadway and berm areas. The scraper was cutting down a slight rise and dumping in the low berm area.

Immediately west of the scraper, the ¾-yd. Byers 83 diesel shovel was excavating a hillock to bring the berm down to grade at that point. The dirt was being loaded into trucks, mostly Fords with 5-yd. Marion dump bodies which hauled the excavated dirt to the several fills mentioned earlier.

In the area already excavated by the shovel, an Oliver Cletrac tractor with

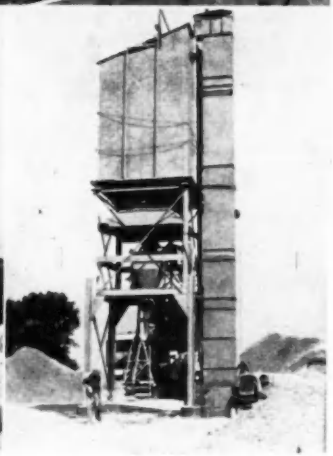
Continued on page 50

• Right: An Allis-Chalmers HD-10 tractor with Gar Wood bulldozer backfills around bridge, compacts with Ingram sheepsfoot rollers.



• Below: Aggregates for pavement construction were loaded to trucks through this 75-ton Blaw-Knox batcher.

• Below Right: Cement was stored in and apportioned by this 400-bbl. Blaw-Knox cement bin and hopper.



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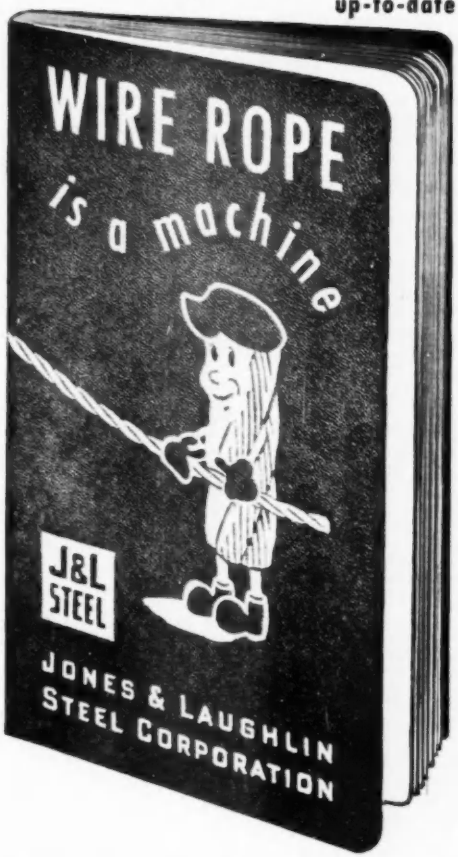

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Equipment You Ought to Know About

Grid Roller

Manufacturer: Hyster Co., Portland 8, Ore.

Claims: The new Grid Roller is entirely different in both principle and appearance from sheepsfoot and rubber tire rollers. It consists of two 5-ft. diameter wheels or rollers attached to a frame which is towed behind a tractor or motor grader. Each wheel is 32 inches in width and made of 10 replaceable sections of heavy, heat-treated alloy steel grid segments bolted onto circular side plates. These grids have the appearance of a woven, open-mesh grid made by interlacing 1½-in. round bars. Openings between adjacent bars are 3½ inches square.

The design of the grid surface with its closely spaced high pressure points surrounded by confined low pressure areas results in a high degree of compaction with minimum lateral shifting of material. There are no projecting teeth to uproot surfaces.

In addition to its use as an earth compactor for airports, dams, levees, fills, road building, etc., the Grid has another main purpose—that of salvaging and maintaining bituminous or black top pavement. After the scarifying has been done, the Grid Roller breaks up and partially pulverizes road mix pavements, compacts the subgrade after the old pavement has been windrowed to the side, and then later compacts the fill of replaced broken-up black top preparatory to final surfacing.

Cleaners with cast teeth which mesh on the inside periphery of the grid wheels are provided for use in clay or loam soils. The action is much the same as two gears running in mesh. The soil deposits are pushed out as the teeth pass into the openings.

A counterweight box is also available to permit easy adjustment of weight to suit soil and tractor requirements. The box weighing 3,500 pounds has a capacity of around 16,500 pounds of wet sand.

Since the roller can perform at high speeds, a fast towing unit is recommended. Motor graders and rubber-tired tractors are satisfactory except for extremely rough or steep surfaces for which a track-type tractor may be used.

Additional information may be obtained by writing the manufacturer and asking for form number 1126.

General Purpose Electrode

Manufacturer: All-State Welding Alloys Co., Inc., 273 Ferris Ave., White Plains, N. Y.

Claims: A general purpose electrode has been developed particularly for maintenance and production work on special steels of the high-alloy and high-carbon types.

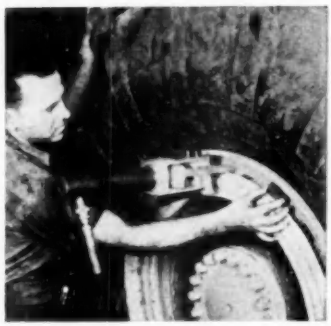
This All-State 252 electrode has a tensile strength of 85,000 to 95,000 psi, accompanied by good heat, corrosion and wear resistance. It welds low-alloy steels without preheat and subsequent heat treat, and joins dissimilar steels, as well as building up case-hardened parts and welding clad steels.

All-State 252 is an AC-DC electrode. Operators should reverse polarity with DC. Preheating the base metal to 300° to 500° F. makes it possible to produce crack-free welds. Its yield strength is 50,000 to 60,000 psi, elongation 35 to 45%, reduction of area 35 to 50%, and impact at room temperature (Charpy Keyhole) 150° to 175° F.

Tire Remover

Manufacturer: Goodyear Tire and Rubber Co., Akron, Ohio.

Claims: A new hydraulic tire remover facilitates changing large earthmover tires. Especially designed to break loose large tire beads from the rims, this tool will operate on any tapered bead rim of Goodyear design.



Portable and highly compact, the equipment consists of a ram assembly 19 inches long, weighing 25 pounds, together with a pump and hose which provide hydraulic pressure for operating, the latter two pieces weighing 16 pounds. These work on both front and back side of rim making it possible to loosen damaged tires from rim so as to effect quick changes right on the job.

Under actual test conditions, the tool has withstood 18,000 pounds pressure at one spot on rim to break tire bead loose.

Rock Bit

Manufacturer: Joy Mfg. Co., Pittsburgh 22, Pa.

Claims: A new Joy Sulmet rock bit is designed for general drilling application. It is a skirt-type bit of the 4-point cross design with tungsten carbide inserts for maximum penetration. It is available immediately in 1⅜-, 1½-, 1⅝-, 1¾-, and 2¼-in. sizes. Other sizes will be made available at a later date.

Centrifugal Pump

Manufacturer: The Deming Co., Salem, Ohio.

Claims: Designed for a wide variety of drainage or water handling jobs where electric power or belting facilities are not available, a new self-priming centrifugal pump is equipped with a 1½-hp, 4-cycle, air-cooled gasoline engine having a high tension magneto.

Pump has cast iron casing, bronze impeller mounted directly on engine shaft, and a mechanical type shaft seal which eliminates need for stuffing box and packing gland. Pipe connections are 1½-in. suction and 1½-in. discharge. Dimensions are 20x13x19 in. Net weight is 83 pounds.

Performance ratings of this pump range from 10 gpm with an 80-ft. head to 90 gpm with 15-ft. head.

This pumping unit is identified as figure 3304.

Weather Guide

Manufacturer: American Optical Co., Southbridge, Mass.

Claims: Accurate local weather information 12 to 24 hours in advance is now available to construction firms. A new, pocket-size weather guide automatically makes forecasts based on cloud formations and wind. Operation of the device requires no special skill, and it is small enough to fit into a pocket.

Two steps are necessary to figure out weather conditions for the next 24-hour period. Direction of the wind is noted and local clouds matched with one of seven pictures of cloud formations on the face of the instrument. Then by turning a dial to align a red arrow with wind direction, the correct weather prediction appears in a little window.

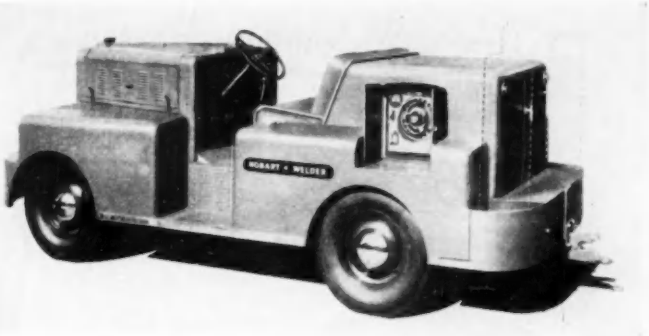
The company points out that research has shown that predictions based on wind directions and cloud formations are more accurate than those from a barometer which considers only air pressure.

Hose Cut-Off Machine

Manufacturer: Aeroquip Corp., Jackson, Mich.

Claims: The Aeroquip hose cut-off machine cuts all types of flexible hose, even hose reinforced with plies of wire braid. It will accommodate sizes up to three inches in outside diameter, cutting hose at 90° (square) in relation to the axis of the hose, without frayed ends.

No coolant is required for the cutting wheel, and all moving parts are guarded. The unit is small enough to mount on any ordinary shop bench and can be moved when not in use.



Mobile Welder

Manufacturer: Hobart Bros. Co., Box 389, Troy, Ohio.

Claims: Weldmobile can be used as a complete maintenance and repair outfit in any location, eliminating the need of electrical connections for electric drive arc welders or towing equipment for trailer-mounted arc welders.

Two new models are now being produced, the GR-301-M with a 300-amp welder for light to heavy welding requirements, and the GR-401-M with a 400-amp welder for medium to extra heavy welding requirements. Either unit can be furnished with 1- or 3-kw auxiliary DC power for supplying lights and universal power tools.

Weldmobile is equipped to reach a job under its own power and make on-the-spot repairs with arc welding, oxy-acetylene welding and cutting, and power tools. A universal coupler is provided on the rear, to permit towing of additional equipment such as trailer mounted welders, air compressors, etc.

It is especially recommended for making welded repairs around quarries, gravel pits, and other industries having extensive operations.

Fluid Shaft Electric Motor

Manufacturer: Reuland Electric Co., Alhambra, Calif.

Claims: New units called Fluid-Shaft motors, feature a single-frame, integral design of motor and fluid-drive coupling. Cost and space savings result.

The Fluid-Shaft units utilize regular Reuland electric motor frames and end bells. Typical installations for Fluid-Shaft electric motors are conveyors, bridge and trolley drives on cranes, and mixers.

All starting and operating shocks are absorbed in a cushion of oil, assuring protection against "jamming" of equipment. Available in standard foot mounted, or round body frames, all units can be mounted horizontally or vertically, or with NEMA flange and face type end bells. No special engineering required for installation.

The units are available in ½, ¾, 1, 1½, 2, 3, 5, 7½, and 10 hp.

4-Cylinder Diesels

Manufacturer: Hercules Motors Corp., Canton, Ohio.

Claims: The DIX4B and DIX4D closed type power units have been added to the DIX4 series of 4-cylinder diesel engines. The DIX4B is 3¼-in. bore x 4-in. stroke with a piston displacement of 133 cubic inches. The DIX4D is 3⅝-in. bore x 4-in. stroke and has a piston displacement of 166 cubic inches.

The DIX4 series feature solid injection, compression ignition, 4-stroke

cycle type. These engines are equipped with pressure lubrication with oil pump mounted inside the oil pan. Main flow lube oil filter is attached to the cylinder block, thus eliminating outside lube oil lines.

The combustion chamber insures complete mixing of fuel and oxygen. It is located at the side of the cylinder bore. During operation, as the piston proceeds to the end of its compression stroke it passes across the passageway

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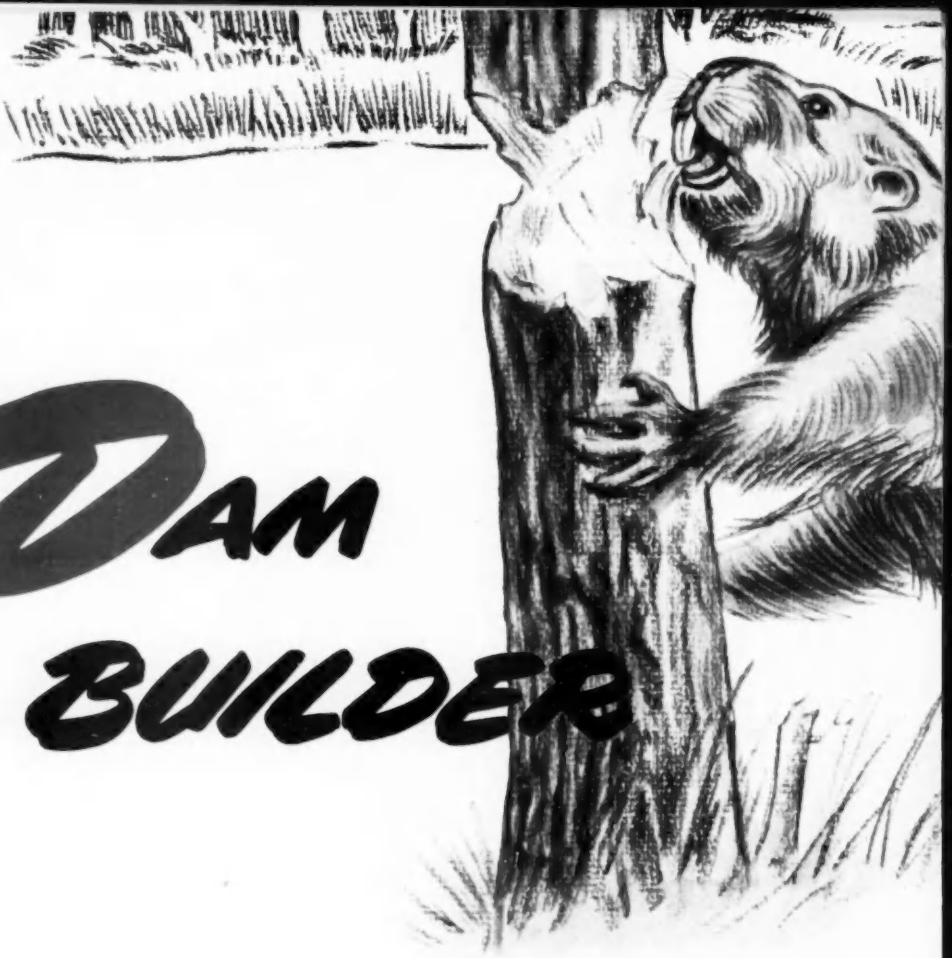

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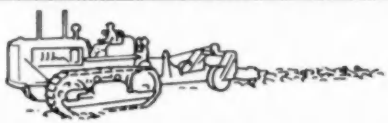

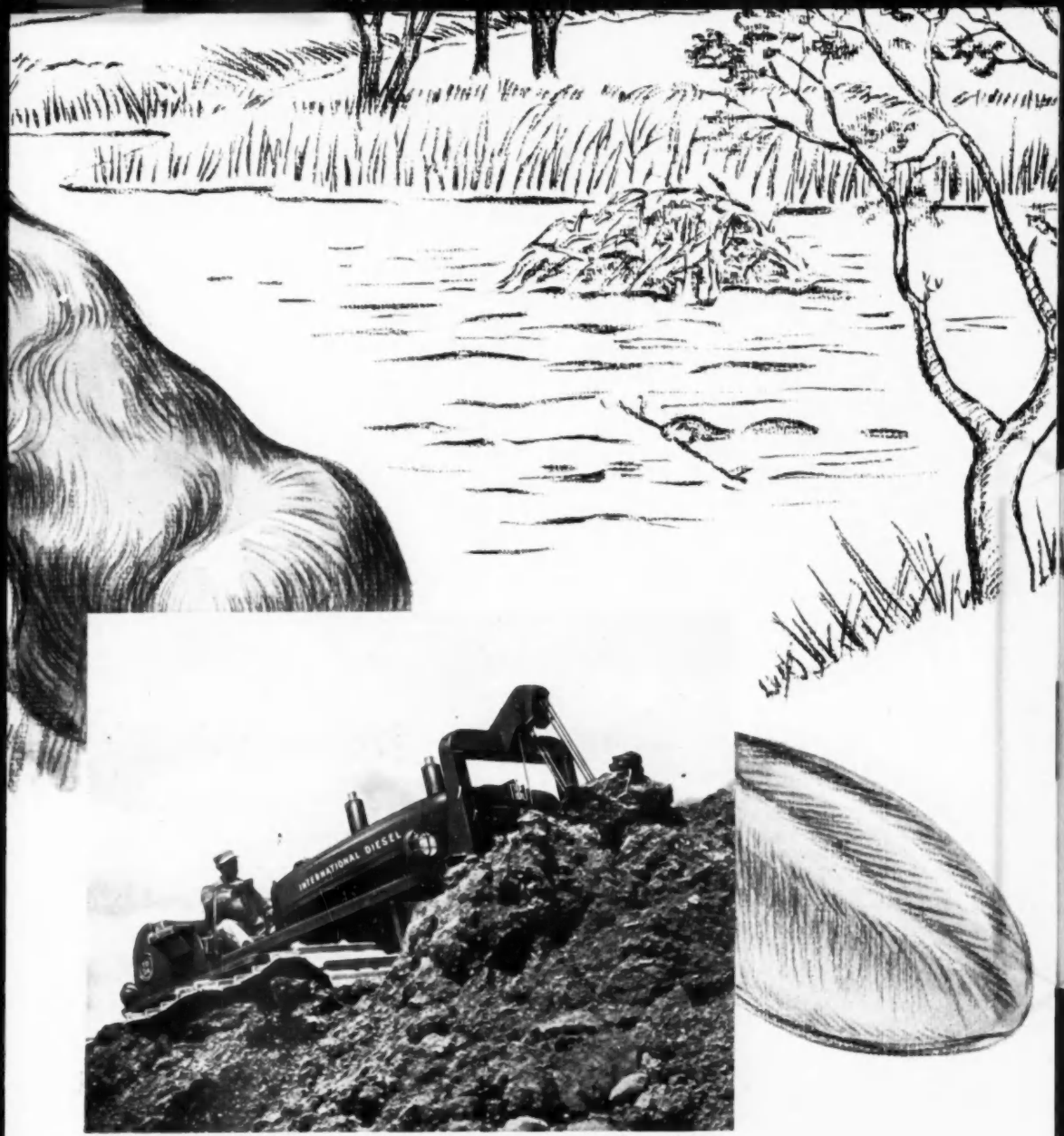

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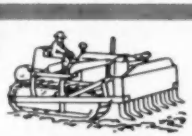
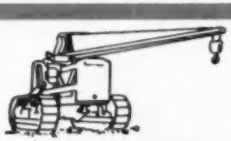

News from the Field

Roads Get Small Part Of Transportation Dollar

Unless more and better traffic arteries are provided, motorists stand to lose all the benefits obtained from technological improvement of the automobile was the conclusion of a study made by the Brookings Institution, Washington, D. C. The report declared that poor highway systems throughout the nation are the greatest obstacle to economical, low-cost automobile transportation.

The author of the report, Wilfred Owen, a highway economist, noted that only 5 to 10 cents of the highway transportation dollar was spent on highways, a proportion that is too low. The rest of the dollar, he pointed out, is absorbed by the purchase price of the car, gasoline, repairs and other operating expenses.

These conditions exist at a time when an unprecedented 40 million motor vehicles, 20% more than the prewar peak, are in competition for highway space. Most of today's roads were declared not adapted to the requirements of heavy volumes of high-speed traffic resulting from population shifts and a notable trend from urban to suburban areas.

The study said that previously the declining unit cost of automotive products had made it possible to increase the levies dedicated to highway purposes "with no net increase in what the user paid for transportation service.

"In more recent years," it added, "the savings from technology have no longer been applied to meet the expanding need for better highways. Instead, these economies have been allowed to serve merely as an offset against the increasing costs of operating on available inadequate highways. As a result, the high cost of poor highways has begun to overtake the economies realized through better cars."

Increasing construction costs were viewed as a major handicap to provide the country with the roads it badly needs. Modern highways, even outside metropolitan centers, sometimes cost $1 million a mile. Expressways in some of the larger cities were reported costing up to seven times that amount, the study found.

"The financial problem of highway modernization is complicated by the high cost of merely maintaining the present system in its inadequate condition," the report went on. "More than half of each dollar spent for highways must be used to maintain those which now exist. Of the amount remaining, the major part must be used to replace pavements that have reached the end of their service life. Very little is left to pay the high cost of new construction."

"A better balance" between expenditures for automobiles and those for roads was urged by the Brookings report.

Step Up Construction Program for CVP

A stepped-up construction program on the Central Valley Project, looking toward the first regular operation of the initial features by 1951, is being charted by the Bureau of Reclamation. The work program of the 1949-50 fiscal year is expected to be the biggest in the project's history.

Several CVP features have been in partial operation for some years, including Shasta Dam, Shasta power plant, Contra-Costa Canal, Friant Dam and the Madera Canal. The most recent addition to this list is Friant-Kern Canal into which water was turned for the first time on July 9.

Friant-Kern Canal is 57% finished. Of its 153-mile length, 75 miles have been completed and 42 are under contract. Two contracts for the final 36 miles will be let during the new fiscal year.

Delta-Mendota Canal (See *Excavating Engineer*, May, 1949, "Nine Million Yards Closer to Mendota," p. 18.) 120 miles long, is 27% finished. Of the first 68 miles now under contract, 33 miles are completed. Bids for the remaining 52 miles will be called for this fiscal year.

The principal contract for the construction of the huge building, intake canal, and discharge lines at Tracy pumping plant (See *Excavating Engineer*, Dec., 1948, "Excavating for Central Valley's Heartbeat," p. 20.) is 60% complete. A contract for completion of all remaining work, including installation of the pumping equipment, is expected to be awarded this month for completion in June, 1951.

Another big unit in the CVP, Shasta Dam, is 99½% complete. The Shasta power plant is 95% finished. Keswick Dam and power plant is 80% complete with remaining items expected to be finished by July, 1950.

Final investigations are being completed to determine the actual route of the Delta Cross Channel. It is expected that the first construction contract will be let this year.

• Scores of cranes and shovels supplied by UNRRA, brought in by Russia, or seized from the Germans, have been mobilized to clear the completely destroyed center of Warsaw, Poland. Each building was blown up individually by the Germans and the reconstruction job offers tremendous difficulties. Here two German steam cranes load out rubble to rail cars in the center of the city near Alleja Marszalkowski.

Safety Council Plans Annual Meeting

The 37th National Safety Congress and Exposition will be held in Chicago from October 24 to 28. Various industries will have safety programs at the Stevens, Congress, Palmer House, Morrison and Sherman Hotels.

Mining Section

Four sessions have been planned by the mining section with the first meeting opening on October 24. Speakers, who will discuss safety and health methods and programs during the meetings are R. Emmet Doherty, dust

• Pacific Coast Aggregates, San Francisco, is supplying the 200,000 cu. yd. of batch concrete being used by Dinwiddie Construction Co., also of San Francisco, in the building of 13-story apartments for a Metropolitan Life Insurance Co. housing project at Parkmerced, near Oakland, Calif. The Noble standard CA154 semi-automatic batching plant was disassembled at Kerlinger, trucked to Parkmerced, and re-assembled with a second 2,000-cu. ft. cement storage silo added. The 1½-yd. Bucyrus-Erie 38-B clamshell is loading to a 150-ton 4-compartment aggregate bin. The plant has turned out as much as 500 yd. in four hours and regularly produces 425 to 450 yd. in the same time.

control engineer of the Anthracite Institute, Wilkesbarre, Pa.; S. S. Arentz, general superintendent of the Combined Metals Reduction Co., Pioche, Nev.; D. H. Platt, mining engineer, U. S. Bureau of Mines, Dallas, Tex.;

Oscar Glaeser, manager of the industrial relations department of the U. S. Smelting, Refining and Mining Co., Salt Lake City, Utah; W. C. Bochert, safety engineer of the St. Joseph Lead Co., Bonne Terre, Mont.; T. Earl Hawkin, manager of industrial relations of the Hollinger Consolidated Gold Mines, Ltd. Timmins, Ont., Canada; W. M. McLeod, Tennessee Coal, Iron and Railroad Co., Bessemer, Ala.; Philip S. Miller, chief engineer of the S. R. Rosolf, Ltd., Baltimore, Md.;

L. C. Moore, chief mechanical engineer of the Cleveland-Cliffs Iron Co., Ishpeming, Mich.; E. A. Tyler, safety engineer of the Resurrection Mining Co., Leadville, Colo.; Carl J. Trauerman, secretary and manager of the Mining Association of Montana, Butte, Mont.; R. F. Wilson, supervisor of safety for the Oliver Iron Mining Co., Duluth, Minn.; and D. M. McFarland, manager of the technical division of the Atlas Powder Co., Wilmington, Del.

J. K. Richardson, Utah Mining Association, Salt Lake City, general chairman of the mining section, will preside at all the sessions, which will be held at the Stevens Hotel.

Construction Section

The construction section of the Council will hold its sessions October 25 and 26, also in the Stevens. General chairman is Otto S. Holmskog, senior construction engineer, Employer's Mutual Liability Insurance Co., Milwaukee, Wis.

Speakers will include Mervyn G. Gaskin, president of Taylor and Gaskin, Inc., Detroit, Mich.; Robert L. Jenkins, Chief, Safety Division, Office of the Chief of Engineers, Department of the Army, Washington, D. C.; and Fred I. Rowe of the W. L. Johnson Construction Co., Columbus, Ohio. A discussion will follow each talk.

A panel of contractors' and manufacturers' representatives answering questions from the floor will be conducted on the topic, "How Can Construction Equipment Operations Be Made Safer and Better?"

Name New Reclamation Engineer at Boise

Donald S. Walter is the new regional engineer for the Bureau of Reclamation at its Pacific Northwest headquarters in Boise, Idaho. He replaces Grant P. Gordon, who resigned to accept a position with the Guy F. Atkinson Co., San Francisco.

Walter comes from his job as construction engineer in charge of completing Anderson Ranch Dam, an earthfill structure in the Boise River Basin in southwestern Idaho. He has also been employed in key positions at Hoover and Grand Coulee Dams, and on the Central Valley project in California. Walter has been with the Bureau since 1928.

Except for six years' service in World War II, Gordon has been an employee of the Bureau since 1927. He was appointed regional engineer at Boise in Fall, 1947.

Gustav A. Swanson has been named construction engineer at Anderson Ranch Dam, succeeding Walter. He has been office engineer on the project since 1944 and has been with the Bureau since 1928. Since then he has worked on the Yakima project and at Hoover, Shasta and Keswick Dams.

Anderson Ranch Dam is situated on the South Fork of the Boise River in southwestern Idaho. When completed, it will make available supplemental water for the 320,000-acre Boise project, provide 40,500 kw of hydroelectric power, and flood control. Major work still remaining consists of completing the outlet works, spillway and power plant, and relocation of reservoir roads.

$30 Million Superhighway To Be Built in Venezuela

One of the world's greatest thrill rides—the 3,000-ft. tortuous climb in a careening taxi along the old Spanish trail from the seaport of La Guaira to Caracas, Venezuela will soon be gone forever. An engineering project of the Venezuelan government will carve a new $30 million superhighway through the mountains and leave the old trail's 395 breathtaking curves just a memory for former travelers. Three steel bridges and a tunnel blasted through the mountains will help to take the kinks out of

Continued on page 42

136 Euclids

●Euclids are working round-the-clock at Garrison Dam, the world's largest rolled fill, located on the Missouri River in North Dakota. The project is being built under supervision of the Corps of Engineers to eliminate destructive floods and provide water for irrigation and power.

Garrison Builders, Inc., Peter Kiewit Sons' Co. and Morrison-Knudsen Co. standardized on Euclids for the Stage I and II contracts on this tremendous job which will require a total of 86 million cu. yds. of excavation, 75 million cu. yds. for the embankment alone.

A fleet of 118 Bottom-Dumps is loaded by 7 Euclid Loaders, large draglines, and shovels. Heavy excavation is hauled by 8 Rear-Dumps of 15 to 22-ton capacity—3 Euclid Water Wagons of 10,000-gallon capacity each provide moisture for fill compaction and haul road maintenance. The "Eucs" haul all types of material . . . rock, sand, top soil, gravel, and clay . . . at speeds up to 32.6 m.p.h. on hauls up to 3 miles long.

Yes, Euclid equipment is making earth moving history at Garrison—and it can move more dirt at lower cost for you, too. Write today for literature or see your nearest Euclid Distributor.

THE EUCLID ROAD MACHINERY CO. **CLEVELAND 17, OHIO**

CABLE ADDRESS: YUKLID

EUCLIDS

Working at GARRISON DAM!

THE WORLD'S LARGEST ROLLED FILL DAM!

Euclid Loader delivers 25 bank yds. of fill material in less than a minute into the big Bottom-Dumps. Peter Kiewit Sons' Co. and Morrison-Knudsen Co. are using 5 Loaders and 66 of these Model LDT "Eucs" to move the bulk of the earth and gravel on their 20,000,000 yd. contract.

"Eucs" of 13 cu. yd. struck capacity receive heaped loads of heavy clay and shale in about 40 seconds. Garrison Builders, Inc., a combine of three well-known Tennessee contractors, are completing their 14,000,000 yd. contract for Stage I construction.

Powered by 300 h.p. Bstane engines, the Bottom-Dump Euclids have plenty of power to move payloads up to 40 tons at high speed on long hauls from borrow pits to the fill. Clean, non-stop dumping saves time and increases production of the hauling fleet.

Move the Earth

Continued from page 39

this gateway to Caracas, the nation's mountain capital.

Work on the Venezuelan version of the Pennsylvania Turnpike is expected to begin this Fall and will go on for 2½ years. When it is finished, the old hour-long drive from La Guaira or from the airport at Maiquetia will be cut to 15 minutes. The speed limit along the 4-lane route will be 80 kilometers per hour.

The present road which snakes around 1,000-ft. cliff walls in an unbroken ascent now carries some 3,000 vehicles a day along a route partly 1-way and partly 2-way. Nearly all traffic enters Venezuela's largest city through this road, and because there are virtually no railroads, this includes most of the city's food and merchandise—not to mention travelers. The length of the present route is 30 kilometers (slightly more than 18½ miles) which must be negotiated at a speed limit of 25 kilometers per hour. The superhighway will reduce the distance to 16 kilometers.

18 Dams Under Construction in Mexico

Eighteen dams over 50 feet high are currently under construction in Mexico to increase the irrigable area of the country, J. Vicente Orozco, chief engineer of the Irrigation Division of the Ministry of Hydraulic Resources of Mexico, told members of the ASCE assembled for their summer convention in Mexico City. These new dams when completed will add about 850,000 acres to the land now under cultivation. Three of the new dams, where power will be produced, will add some 200 million kwh to the nation's annual hydroelectric power output.

Since 1926, the Mexican government has been pursuing a policy of building dams to store water for irrigation and, including the structures now under way, has built a total of 43 dams more than 50 feet high in this 23-year period. The total combined storage, Orozco stated, will reach nearly 11 million acre-feet and will provide irrigation water for nearly two million acres and for the generation of nearly 400 million kwh of electrical energy yearly.

The earth dam is the prevailing type used in Mexico, Orozco told ASCE members. Reason for this is threefold: (1) geological conditions, which are generally unfavorable for concrete dams because of the presence of fractures and faults; (2) the width of river valleys, which frequently require dams of considerable length; and (3) economic factors, such as the high cost of concrete structures. Another factor he mentioned is the more specialized knowledge and workmanship required for concrete dams and the fact that Mexican engineers are generally more familiar with earthwork jobs.

Most of the dams are of the earth and rockfill type, he said, because unit prices are lower for this type under conditions in Mexico and because a steeper slope can be used than for the dam built of graduated material. Local materials are utilized to the full, he explained, giving as examples Sanalona Dam, where decomposed granite was used to advantage, and Valsequillo Dam, where weathered calcareous conglomerate was employed.

● The bell for the Resurrection Church, Chicago, is lifted to its tower and positioned by a Bucyrus-Erie 22-B truck crane with an 85-ft. boom. The crane belongs to Speedway Wrecking Co., Chicago.

Foundation Settlement Problem

Since the Spanish Conquest, Mexico City engineers have struggled with the problem of founding heavy buildings on the spongy clay which underlies the city, Ing. Pedro Albin, Jr., construction engineer for La Latina Americana, told members in another talk. Not only is the whole plateau on which Mexico City is built gradually settling, but also local settlements are occurring where buildings are too heavy for the soft clay on which they are founded.

These foundation conditions have caused some strange phenomena. The Independence Monument, which was built on piles to avoid settlement, continually appears to grow in height as the level of the surrounding streets falls, Albin explained. The sidewalk around the monument has been relaid several times but the difference in levels continues to increase, as shown by the way sidewalk slabs slope downward from the monument toward the surrounding streets.

Buildings Settle Faster Than Streets

Sometimes, where a building is too heavy for the carrying capacity of the soil, the structure settles faster than the surrounding streets. One concrete building has settled so far that the ground floor is a foot or more below the street level. This settlement has taken place in a 5-year period. A slight

tipping of the structure is also noticeable Albin said, caused by the fact that the center of the foundation does not coincide with the center of gravity of the building.

To avoid a similar difficulty in the case of the building now under construction for his company in Mexico City, Albin said, it has been proposed that the ground-floor slab be mounted on screws so it can be lowered as surrounding streets settle.

For the past 30 years long wooden piles—about 112 feet—have been driven under the buildings to secure support from a deeper and stronger stratum. For the foundation of the new building of La Latina Americana, a type of long concrete pile is being introduced from the United States. This type of pile, which has a precast concrete "button" on the end, is well adapted to foundation conditions in Mexico City, Albin declared.

20-Ton Crane "Vanishes"

Thieves around Wilmington, Dela., have a magician's touch—apparently. They managed to get away with a 20-ton motor crane with a 40-ft. boom without a soul noticing it.

The $10,000 machine was parked—safely, it was thought—at a service station at nearby Aniline Village. But, when its owner, Thurman Short of Claymont, took a prospective buyer to look at it one Sunday, it was gone.

It was last seen over the Pennsylvania line by police who were unaware of its theft. Two unidentified men were working on it. It was a mystery to Short and the local law how the 20-ton machine was able to clank through a populated area at the crawling pace of less than 25 miles an hour and not attract someone's attention. But it had.

Construction Exposition Ahead for Houston

The Houston Construction Industries Exposition has scheduled its second annual program from September 25 through October 2 in the Sam Houston Coliseum. Preliminary planning for this "world's fair" of the entire building industry, is based on an expanded renewal of last year's inaugural effort which drew 335,000 visitors.

Hundreds of manufacturers' and special exhibits will bring displays of every sort of product and service that goes into residential, commercial and industrial building. These displays are the chief portion of this annual clinic where architects, engineers and general contractors gather to study the industry. Applications from new exhibitors will increase the number of displays over 1948.

• A small island off the southwest corner of Nova Scotia, Cape Sable Island, is now connected to the mainland by a half-mile causeway built by the Nova Scotia government. This photo shows the meeting of two International tractors, a TD-18 (left) with a Bucyrus-Erie Bullgrader and a TD-9 with a Bucyrus-Erie Dozer-Shovel. The TD-18, owned by Armstrong Bros., Brampton, Ontario, Canada, leveled off loads of earth and rock fill—600,000 cu. yd. were dumped into the causeway. The TD-9 was used by Ralph and Arthur Parsons, Ltd., Windsor, Nova Scotia, to build a road connecting the causeway with other routes on the island.

In addition to the construction industry and general public visitors, other specialty groups will attend the Exposition. Representatives of the building and construction trades department of the A. F. of L. as well as national officers of the AGC will be in Houston for the September 25 opening. Student engineers, architects and draftsmen from all the major colleges and universities in the Southwest will also attend.

The exposition is presented by the Houston Chapter of AGC. Exposition policy committee is headed by Russell Nix. Loy Duddlesten is general manager of the show.

White Elects Kurtz

Ford Kurtz has been elected vice-president in charge of engineering for J. G. White Engineering Corp., New York, N. Y. Kurtz is also a director of the company and since 1940 has served as engineering manager and chief hydraulic engineer.

A member of the ASCE, Kurtz has had charge of the design of many of the hydroelectric plants engineered and constructed by White for such utilities as Central Hudson Gas & Electric Co. and the Tennessee Electric Power Co.

In addition, Kurtz has served as

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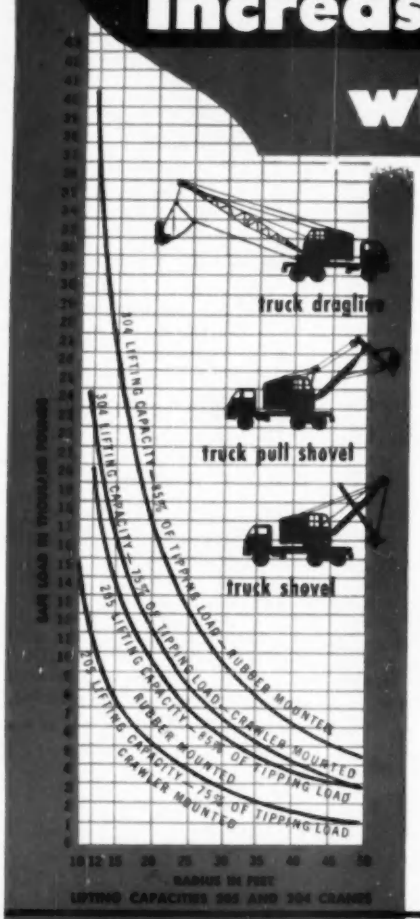
• Artist's sketch shows North Dam, a part of the Bureau of Reclamation's Columbia Basin Project. It will require a million cu. yd. of fill. The 1,350-ft. earthfill embankment will block the Upper Grand Coulee river about three miles from Grand Coulee Dam to form the 27-mile equalizing reservoir of the Basin irrigation system. Electric City is indicated at top right of drawing. A 9,100-ft. feeder canal (foreground) leading from the outlet of Coulee Dam's pumping plant will be included in the North Dam contract.

Increase Lift Capacities with KOEHRING


truck dragline
truck pull shovel
truck shovel
304 LIFTING CAPACITY—85% OF TIPPING LOAD—RUBBER MOUNTED
304 LIFTING CAPACITY—75% OF TIPPING LOAD—CRAWLER MOUNTED
205 LIFTING CAPACITY—85% OF TIPPING LOAD
RUBBER MOUNTED
205 LIFTING CAPACITY—75% OF TIPPING LOAD
CRAWLER MOUNTED
RADIUS IN FEET
LIFTING CAPACITIES 205 AND 304 CRANES

YOU ALSO GET MORE BOOM LENGTH ...FASTER SPEEDS ON RUBBER

Wherever you have heavy lifting work requiring frequent moves on location, or job-to-job, it pays to use Koehring rubber-tired Truck Cranes. First, compare the increase you get in lifting capacities:

Koehring 304 Truck Crane safely lifts up to 40,000 lbs. . . . 8½ tons more than crawler rating. The smaller, heavy-duty 205 Truck Crane, with its 20,000 lb. lift on rubber, also increases load capacity by about half.

INCREASES WORK RANGE

Extra stability of truck crane mounting also increases work range . . . boom length on the Koehring 205 Truck Crane is stepped up from 50 to 85' . . . and reach on the 304 is increased from 70 to 110' maximum. Koehring's pendant boom suspension simplifies changing boom lengths, cuts reeving time, saves boom suspension cable.

TURN TRAVEL TIME INTO WORK TIME

These mobile Truck Cranes roll along at traffic speeds of 30 to 35 m.p.h. . . . get to job fast, start work sooner. No waiting for trailer . . . no planking. Hinged booms fold back for ample travel clearance . . . save more time every move.

Figure what these three big gains in extra capacity . . . extra reach . . . and extra speed can mean on your jobs! Remember, too . . . both the truck-mounted 304 and 205 are fully convertible from lift crane to Koehring shovel, pull shovel, dragline, clamshell or pile driver, extending the speed, mobility and economies to all of your materials-handling jobs. Also available on cruiser mounting. Other Koehring sizes: big 605 and 1005.

DUMPSTORS® with their 6-yard rock body . . . 1-second gravity dump . . . constant-mesh transmission and 3-speed travel forward and reverse, give you fast, no-turn shuttle haul. Result: more trips per hour . . . more yards per hour on rough, off-road hauls.

KOEHRING heavy-duty shovels can cut excavating costs. Compact, accessible machinery arrangement of 1½-yard 605 illustrated lowers maintenance costs, increases work-time. Other Koehring sizes: ½-yard 205, ¾-yard 304 and big 2½-yard 1005.

up to 50%
TRUCK CRANES

HEAVY-DUTY 304

Ideal on heavy lifting work where travel time is an important percentage of job duration. With Koehring 304 Truck Crane, operator has full visibility up, down, left or right . . . controls are safe, sure . . . completely responsive. Big, heavy-duty clutch . . . large brake surface . . . reserve strength, beyond rated lift capacities, assure accurate, safe control.

HEAVY-DUTY 205

In addition to its extra margin of heavy-duty strength, the Koehring 205 Truck Crane has many *plus* features: independent boom hoist . . . self-adjusting main clutches . . . spring-loaded, boom-hoist brake, which holds automatically . . . clutch throw-out boom limit stops . . . telescopic boom-limit stops. . . . power-boom lowering device. These are standard equipment on all Koehring Truck Cranes . . . for safe, versatile operation.

KOEHRING HEAVY DUTY

ASK YOUR KOEHRING DISTRIBUTORS ABOUT SAVINGS IN TIME AND MONEY ON YOUR WORK.

K902

KOEHRING Company, Milwaukee 10, Wisconsin

Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

Continued from page 43

resident or consulting engineer on the construction of power projects for the United States government, the U. S. S. R., and the Government of Ethiopia. He also did extensive consulting work in connection with the water supply for the City of Philadelphia and with the Los Angeles aqueduct of the Metropolitan Water District of Southern California.

Va. Uses Old Roads In Building New

Virginia is speeding along 4-lane divided highway construction on the state's arterial highways by utilizing existing roadways. A modern 2-lane highway is constructed alongside the old road to carry traffic in one direction; the existing highway handles traffic in the other. After the old roadway has reached the end of its useful life, it will be rebuilt to modern standards.

Some 45 miles of this kind of dual highway have been built since the highway department's 20-year plan for road improvement became operative at the end of the war.

A similar economy method has been followed in the construction of 17 bridges where there is danger of high water flooding. The new bridge is constructed well above flood level. If high waters inundate the older bridge, traffic in both directions is routed over the higher structure.

Hinman Co. Gets Platoro Dam Contract

The Bureau of Reclamation has authorized the award of the construction contract for Platoro Dam on the Conejos River, Colorado, to Hinman Bros. Construction Co., Fort Collins, Colo., on a bid of $2,727,792. The 135-ft. earthfill dam which will be high in the Rocky Mountains in southern Colorado, will provide water storage for the Conejos Division of the San Luis Valley Project.

Platoro Dam will create a reservoir of 60,000 acre-foot capacity, the highest level of which will stand at 10,042 feet above sea level. It will be the largest man-made lake at this height in the United States.

Hinman has 1,300 days to complete the work. The reservoir is expected to store water for supplemental irrigation use by farmers in the Conejos Division of the San Luis Valley by 1953.

Contract Authorized For Wellton-Mohawk Project

Award of contract for the construction of the first 8.5 miles of main canal on the Wellton-Mohawk division of the Gila project has been authorized by the Bureau of Reclamation. Low bidder on the job, the first major construction contract on this division, is the Fisher Contracting Co., Phoenix, Ariz., with a bid of $1,335,463.70. Work is to be completed within 525 calendar days after the notice to proceed is issued.

The Wellton-Mohawk division consists of 75,000 acres of the Gila project located along the Gila River, beginning some 15 miles east of Yuma, Ariz., and extending 35 miles eastward. Wellton is the principal town of the area, being approximately at the center of the development. The presently irrigated area in the Wellton-Mohawk division is threatened by salt water intrusion on the underground supplies. Construction is to be expedited to rescue this section, as well as provide new settlement opportunities on irrigated land.

First irrigation on the Wellton-Mohawk division is contemplated during the 1952 fiscal year.

Mine Conveyor Saves Sinking Building

A mine conveyor is undermining a building in South Kearney, N. J., where, until recently, warehouse number 7 of the American Stores Co., was in danger of disappearing into the Jersey marshes. Main difficulty facing the Underpinning and Foundation Co., New York, N. Y., contractors for replacing the building's sinking foundation was the removal of 16,000 cu. yd. of dirt from a space with headroom of less than 10 feet—not enough for regular digging equipment.

The problem has been solved with the installation of a Robins mine conveyor. Before the unit was put into operation 60 cu. yd. was hauled out each day. At the end of four weeks' operation, the belt system was found to be averaging 250 cu. yd. a day. Five gangs of workmen dig out around the foundation and load the dirt on the belt which carries it out from beneath the building.

Otto Carlson, superintendent, reports that the conveyor, by carrying away the dirt faster than it can be dug out, has provided more jobs by enabling him to increase his labor force sooner than expected.

The present 239 feet of conveyor belting will eventually be increased to 440 feet as digging progresses.

• At Kearney, N. J., where a warehouse of the American Stores Co. was settling into the Jersey marshes, a Robins mine conveyor—normally used to carry coal around a mine—is moving 250 cu. yd. of dirt a day out from under the stricken building to make room for a new foundation. Underpinning and Foundation Co., New York, N. Y., is handling the job. Dozers shown are a Caterpillar D-4 (center) and an International-mounted Bucyrus-Erie TD-6.

Tractor-Scraper Team Stockpiles Sodium Sulphate

In 90 days during the past winter's cold months, Pigott Construction Co., Saskatoon, Saskatchewan, Canada, stockpiled 400,000 yd. of sodium sulphate from what was once an ordinary alkali lake 100 miles west of Regina.

• Against a crumbly, white highwall of lime rock, a homemade crusher and conveyor feeding a Ford truck gets a load of material from the ⅜-yd. dipper of a Bucyrus-Erie 10-B. The shovel moves 300 yd. every 10-hour day for its owner, the Cummer Lime and Mfg. Co., Ocala, Fla., in the firm's Zuber, Fla., quarry.

Saskatchewan. The contractor used Allis-Chalmers tractor-drawn 15- to 16½-yd. LaPlant-Choate and LeTourneau scrapers to accomplish the job.

Three reservoirs, which are roughly 1,000 feet square and 12 to 15 feet deep, have been dug out near the alkali lake. A ditch brings the salt solution from the lake to a pumphouse near the reservoirs. They are filled during the summer when the concentration of salt in the lake is at its highest—about 50%. As the weather gets colder, the salt crystallizes and settles to the bottom. The water is drained off, and for about 90 days during the coldest part of the winter, the salt is removed and piled near the end of a long conveyor which supplies a salt processing plant. The winter operations make it possible for the plant to operate all year round.

Weighs One Ton Per Yard

Sodium sulphate weighs about one ton per yd. It is handled most easily at temperatures of zero and below because it is too soft and sticky to take out of the reservoirs in warm weather.

In processing, the salt is first crushed then placed on the conveyor belt still containing about 60% moisture. Most of this moisture is removed by blowing it through an oil furnace and the remainder is removed as it passes through a rotary drier. The dried material is 98 to 99% pure and looks like portland cement, but is not as fine.

After the salt is processed, it is used in the manufacture of paper, steel refining and new types of detergent soaps.

From the States

New Taxes Build Minn. Road Funds

Bills increasing the state gasoline tax and boosting motor vehicle license fees have been enacted by the Minnesota Legislature to provide $10⅓ million in additional annual highway revenue.

The gasoline tax was raised from four to five cents a gallon to yield an estimated $6⅓ million in additional yearly revenue, part of which will go to counties.

Increased motor vehicle licenses will bring in an extra $4 million a year. The new legislation slows up reduction in license fees for passenger cars. Under the measure, minimum licenses will not apply until a car is nine years old when the mimimum will be $10.00. A $7.50 minimum which until now applied to 5-year-old cars, will become effective only after a car is 19 years old.

Trucks are reclassified under the new law, "X" classifications eliminated, fees for regular trucks cut, and for semi-trailers increased. A general 10% increase in taxes now paid by over-the-road busses is also part of the legislation.

Besides increasing revenues, other highway legislation enacted in Minnesota added 721 miles to the state trunk highway system and provided for extension of secondary roads through cities and villages.

Dela. Approves $9 Million Bond Issue

Gov. Elbert N. Carvel has signed into Delaware law a bill authorizing a $9 million bond issue for a state highway improvement program. A companion measure appropriates $1,280,000 to refund certain state highway bonds.

A bill increasing Delaware's gasoline tax rate from four to five cents a gallon was passed by the Delaware Legislature just prior to adjournment of its 1949 session.

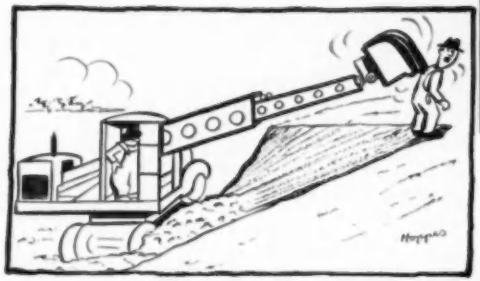
Neb. Votes Higher User Taxes

The Nebraska Legislature has enacted a 3-point program for highway improvement. It includes a 1-cent gasoline tax which brings the fee from five to six cents a gallon, increased registration fees, and equalization fee for diesel-powered vehicles. It is estimated that the three bills will increase

Continued on page 49

• In the cold of Canada's winter, two tractor-scraper units pick up their loads of sodium sulphate from a reservoir about 100 miles west of Regina, Saskatchewan, Canada. The rigs, which belong to Pigott Construction Co., a contractor of Saskatoon, Saskatchewan, are both Allis-Chalmers tractor-drawn. An HD-10 pulls a LeTourneau scraper (left) while an HD-19 hauls a LaPlant-Choate.

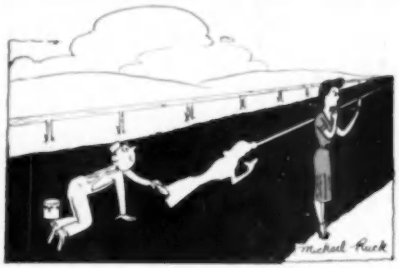
Ex-Laffs



"A LITTLE HIGHER!"

"AFTER ALL, DEAR, YOU WATCHED THEM WORK ALL DAY YESTERDAY!"

"DEAR, A LETTER FROM THE FREEWAY PLANNING COMMITTEE CAME WHILE YOU WERE OUT OF TOWN!"



"NOW, RIGHT HERE WE'LL PUT THE FIRST AID STATION."

From the States

Continued from page 47

highway funds by $5 million annually. Registration fees for most passenger cars will be increased from $5 to $8 while fees for medium-sized and small trucks will be approximately double. Fees for trucks with a net load of 25 tons will be increased from $500 to $750. The revenues will support an expanded highway construction plan.

Ohio Enacts Turnpike Law

Ohio has created a 5-member Ohio Turnpike Commission empowered to build toll highways in the state at an estimated cost of $200 million. The proposed highways would run approximately 234 miles, from near Petersburg across Ohio, just south of Cleveland and Toledo.

The act empowers the governor to name four members for the commission, who, with the state highway director, as an ex-officio member, would have power to acquire land through the exercise of eminent domain and issue bonds for the construction of toll highway facilities. Bonds are to be paid for out of revenue collected from motorists who use the toll road. Following retirement of the bonds, the turnpike would become a part of the state highway system.

Contemplated Ohio toll roads authorized under the law would connect with the Pennsylvania Turnpike when that highway is extended to the Ohio line. It also permits a construction of other toll roads between heavily-populated areas of the state. The governor's approval will be needed for whatever additional routes the commission chooses.

N. C. Approves Rural Road Plans

A $200 million rural road bond program was approved by North Carolina voters in a special statewide election. In sanctioning issuance of the road bonds, the voters also approved a 1-cent increase in the state gasoline tax. The tax boost lifts the total rate to seven cents a gallon, will go into effect on January 1.

It is estimated that it will take four or five years to complete the rural program. Plans call for paving of 12,000 miles of rural roads, with special attention to school bus routes, and all-weather surfacing of another 35,000 miles. The road fund will be allocated among the counties according to their area, population and road mileage.

North Carolina's Legislature has enacted a bill authorizing the organization of "municipal corporations" to construct and operate toll roads. Such

HALL-SCOTT *BUTANE* ENGINES help build world's largest earth dam

On the Missouri River 75 miles west of Bismarck, North Dakota, contractors are building Garrison Dam, the world's largest rolled earth structure.

Helping to move the 70 million cubic yards required is a fleet of 72 Euclids powered with Hall-Scott Series "400" Butane Engines. With a gross weight of 141,000 lbs., including 78,000 pounds payload, these units operate at speeds up to 26.8 mph!

Hall-Scott engines are performing magnificently in summer heat, in subzero cold, even in choking dust and dirt. Whatever you're hauling . . . earth, timber, oil, rock, merchandise . . . count on Hall-Scott for unexcelled power, minimum maintenance, clean operation, long life, high torque at low rpm.

For original equipment or repowering, get the facts on Hall-Scott. Butane or gasoline equipped.

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corporations would have the right of eminent domain to secure rights-of-way not to exceed 100 feet in width and to issue revenue bonds for financing toll roads.

The bonds and their interest would be exempt from taxation by the state, counties, or municipalities. The act provided that the State Highway Commission could take over all roads built by the municipal corporations by assuming their obligations.

Shortly after the passage of the bill, steps were taken to organize the Carolina-Virginia Coastal Highway Corp. to construct a toll road along the ocean to connect Nags Head with Virginia Beach. The proposed highway, which would open up a region with no roads at present, is expected to cost between $1½ and $2 million.

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The complete packaged PIPE SYSTEM for fast-laying, temporary and semi-permanent lines for water, compressed air and other services.
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Pa. Has $220 Million Road Budget

With the 1-cent increase in the Pennsylvania gasoline tax (effective, June 1) plus the establishment of the new State Highway and Bridge Authority with bond-issuing powers, the state can proceed with a $220 million highway construction schedule in 1949-51. This report has been made by State Secretary of Highways Ray F. Smock to Gov. James H. Duff.

In the 1947-49 fiscal period, Pennsylvania expenditures for construction, reconstruction, resurfacing and widening reached an all-time high of $184,774,000. More than $111 million of that amount were spent in 1948-49, which, according to Smock, "is the largest sum of money ever expended by any state for highway construction in a single year, and is a larger amount than ever expended by any nation, outside of the United States, in a single year." Smock emphasized that studied consideration is given to each project and its need.

With the gasoline tax increase, which raised the total rate to five cents a gallon, $90 million a year will be available for construction. The State Highway and Bridge Authority can finance projects amounting to an additional $40 million in the next two years. Of the road funds to be spent by Pennsylvania in the current 2-year period, the Federal government will contribute about $20 million.

The State Highway and Bridge Authority already has taken over six major projects, including the new Schuylkill Expressway from the eastern extension of the Pennsylvania Turnpike at King of Prussia to the Philadelphia city line. The state highway program does not include the $87 million eastern extension of the turnpike, which is being built by the Pennsylvania Turnpike Commission.

A special report by the Vermont State Highway Department, prepared in cooperation with PRA, shows that 4,620 miles of roads on all systems and 706 structures on the state system need to be improved at an estimated cost of $124 million. At present taxation rates, the anticipated annual average funds available for highway purposes will be almost $10 million, of which over $5 million should be available for construction after administrative deductions.

The report states that it will take 11 years to complete the needs on the town system, 12 on the state aid system, and 33 on the state system. Deficiencies occurring during these periods would be in addition to the present needs.

Over 2,500 miles of additional gravel highway are needed on the town system if every farm is to be served by a gravel road. From five to 20 years are necessary in the various towns to carry out the present requirements.

Superhighway

Continued from page 32

Heil hydraulic bulldozer was grading and leveling. This work was going on just a jump ahead of a Buckeye 120 traction ditcher, a Haddad machine which was digging a 2½-ft. ditch for placing of 6-in. drainage tiles.

Fine Grading

About 400 yards farther west, a Galion 116 patrol grader was fine grading the roadway preparatory to laying classified embankment material for blanket course. The sand and gravel mixture was being hauled by truck from nearby sources, and was being spread by an Allis-Chalmers HD-7 tractor with a Gar Wood hydraulic bulldozer.

A good start on the paving portion of the contract, the principal item of which is 100,762 sq. yd. of 8-in. reinforced portland cement concrete, had been made in the Village of Lafayette, at the western end of the project. Here two 12-ft. lanes are being built on either side of the existing center strip. The outside lane on the south side had been paved, and the paving crews were working back on the outside lane on the north side. A Multifoote 34-E Duomix paver was mixing and placing the concrete. A Jaeger finisher was following the paver.

Batching Plant

Batch material for the paving was being trucked from the batching plant erected by Ringwald at a point near the eventual center of the project, about 3½ miles east of Lafayette. The plant consists of a 400-bbl. Blaw-Knox cement bin and hopper and a 75-ton Blaw-Knox batcher. A P & H 206 crane is used to load sand and gravel to the batcher.

Also near the center of the project are the joint field offices of W. H. Ringwald and Sons Co., Inc., and the State Highway Department. The offices have been established in an empty farmhouse at the roadside.

Approximately 100 men are employed by the various contractors on the project. The basic shift is an 8-hour stint starting at 7:30 AM. Some shifts are lengthened to nine or ten hours, however, depending on the requirements of the work which is underway at this time.

Work on Schedule

Work on the project is proceeding on schedule despite a temporary slow-up in the Spring occasioned by a week or so of steady bad weather.

Supervising the project for W. H. Ringwald & Sons Co., Inc. is F. W. Jacobs, a man of long experience gained in many similar undertakings. Heading up the 10-man contingent for the highway department is H. E. Stritmatter, project engineer. The project is under the jurisdiction of the highway department's Division No. 6 office at Delaware, Ohio. Octave Ammon is the division engineer; J. Morrissey is division construction engineer.

Equipment on Project

W. H. Ringwald & Sons Co., Inc.:
- P & H 206 crane
- ¾-yd. Byers 83 diesel shovel
- International TD-18 tractor with Bucyrus-Erie hydraulic Bullgrader
- 10-yd. Heil C-10 scraper
- Allis-Chalmers HD-10 tractor with Gar Wood hydraulic bulldozer
- Ingram 1146W tandem sheepsfoot roller
- Allis-Chalmers HD-7 tractor with Gar Wood hydraulic bulldozer
- Galion 116 patrol grader
- 10-ton, 3-wheel Galion roller (24-in. rear wheels)
- 10-ton, 3-wheel Galion roller (20-in. rear wheels)
- Multifoote 34-E Duomix paver
- Cleveland Formgrader
- Blaw-Knox concrete spreader
- Flynn Surgrader
- Neccson concrete curing machine
- 400-bbl. Blaw-Knox cement bin and hopper
- 75-ton Blaw-Knox batcher
- Ford flatbed truck with 1,000-gal. tank
- Jaeger finisher

George A. Stein & Sons:
- Bucyrus-Erie 22-B crane
- 75-cfm Jaeger compressor

Haddad Construction Co.:
- ¾-yd. Northwest shovel
- Oliver Cletrac H. B. 35 bulldozer
- Buckeye 120 traction ditcher
- Le Roi 105 air compressor

Why users prefer the new LaCROSSE *Spring-Mounted* DF6C

FRANK MASHUDA CO., MILWAUKEE, *says:*

"We've found our 24-ton LaCrosse DF6C much easier to handle than solid axle trailers. Spring mounting also gives improved riding . . . better road bearing . . . permits higher speeds with less tire wear for comparable loads and mileage."

H. B. CHURCH TRUCK SERVICE CO., BOSTON

"Higher travel speeds without jolting the load sold us on LaCrosse spring-mounting. Our 19-ton DF6C easily carries 12,700 bd. ft. of lumber per trip on 40-mile hauls . . . also saves time loading and transporting all kinds of heavy bulk loads.

YOU, TOO, can move big loads faster, easier, at less cost with LaCrosse *spring-mounted* trailers. 19 to 33-ton capacity . . . flat, drop or low drop designs. Also standard low beds from 8 to 67-ton cap.

Check Today! LC-5

LA CROSSE TRAILER CORPORATION, La Crosse, Wis.

☐ Rush complete facts on new 19 to 33-ton spring-mounted trailer.

☐ I may be interested in this type trailer about..... (date)

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Name..... Title.....

Employed by.....

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Low-Cost TRAILER TRANSPORTATION

Take a LONG LOOK at BUCYRUS ERIE 4-Wheel Scrapers...

S-68 scraper (6 cu. yd.) moves sand and clay fill on creek-rerouting job in Pennsylvania. Averaged 112 yards per hour on 900-foot haul (one way).

. . . Because these new scrapers are packed with advantages for producing more yards per hour on your dirt moving contracts. Run through the features listed here — consider what they mean to you in greater output and lower costs. Then ask your International Industrial Tractor distributor for added facts!

BUCYRUS-ERIE CO., South Milwaukee, Wisconsin

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- ✓ **The famous Bucyrus-Erie double-curve cutting edge means heaped uniform loads, more pounds of dirt per cubic yard of rated capacity.**
- ✓ **Positive rolling ejection—quick clean dumping.**
- ✓ **Adjustable two-part apron — fits apron action to the job.**
- ✓ **Low-centered stability — scraper clings to steep slopes.**
- ✓ **Positive flotation—big low pressure tires, same size all around.**
- ✓ **Straight line cable reeving, no side bends — low rope wear.**
- ✓ **Adjustable bar-type push bumper, positive bowl return, reversible side cutters, sliding type bowl lock, wedge-socket cable anchors.**
- ✓ **S-Type units in 4, 6, 8, and 10 cubic yard (struck) sizes.**
- ✓ **B-Type units in 15 and 22 cubic yard (struck) sizes, for use with International TD-24 tractors.**

145T49C

See Your INTERNATIONAL Industrial Tractor Distributor

Boom!

"Has that florist any children?"

"Two. One is a budding genius and the other a blooming idiot."

"You know, Edith, every time I see you my heart beats faster and I feel the urge to do bigger and better things. I feel so strong and virile. Do you know what that means?"

"Sure, it means in about five minutes you and I are going to have a wrestling match."

"Why does Geraldine let all the boys kiss her?"

"She once slapped a lad who was chewing tobacco."

He was a small, timid catskinner—the wallflower of the party celebrating the completion of the dam construction contract. But when the orchestra played a familiar and sentimental tune, he took courage and walked across the dance floor. Picking out a beautiful but haughty damsel, he asked: "Pardon me, Miss, may I have this dance?"

After a quick glance at his diminutive size, she replied: "I'm sorry, but I never dance with a child!"

The catskinner paused just a moment, then bowed deeply, "Oh, I beg your pardon," he said. "I wasn't aware of your condition!"

Beauteous Miss: "Isn't it funny that the length of a man's arm is equal to the circumference of a girl's waist."

Engineer: "Let's go get a tape measure and see."

A catskinner on his day off wandered into the tennis match and sat down. "Whose game?" he asked. A shy young thing looked up hopefully, "I am."

NOT in the *Contract*

Visitor: "Doctor, what can you say to a beautiful girl who is so scary she jumps into the nearest man's arms when she's frightened?"

Doctor: "Boo!"

"Jimmy surprised me by telling me that we're going to take our honeymoon in France."

"How nice—and how did he spring that on you?"

"He said as soon as we were married, he would show me where he was wounded in the war."

Angry Motorist: "Say, this car you sold me can't climb a hill! You swore up and down it was a good car."

Salesman: "I didn't swear up and down. I said on the level it was a good car."

Jim: "When you asked the wallflower to dance, did she accept quickly?"

Jack: "I'll say she did. She was on my feet in an instant."

The contractor had just bought a cigar in a department store and started to light it.

"Didn't you notice the sign?" asked the salesgirl.

"What!" exploded the contractor. "You sell cigars in here but you prohibit smoking?"

"We also sell bath towels," replied the salesgirl.

Girl: "I'd like to see the captain of this ship."

Sailor: "He's forward, Miss."

Girl: "That's all right. This is a pleasure trip."

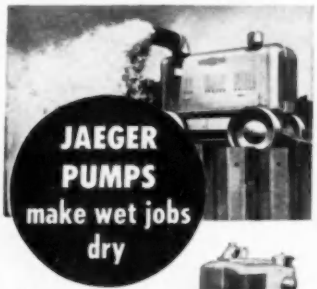
A son in college was applying pressure for more money from home.

"I cannot understand why you call yourself a kind father," he wrote his dad, "when you haven't sent me a check for three weeks. What kind of kindness do you call that?"

"That's unremitting kindness," came the reply.

"It's the best we can do until those dipper teeth come from the factory."

New 2" aluminum pump weighs 105 lbs., pumps 9000 gph . . . Gives high head performance for price of low head pump.



Extra power and double priming action to dewater faster. Built to outlast cheaper pumps by thousands of hours.

Heavy duty 2" to 10" models for low or high head requirements. Super-Jet pumps for pressures to 275 lbs. Diaphragm and caisson pumps. Get catalog.

THE JAEGER MACHINE COMPANY
Columbus 16, Ohio

U.S. 99

Continued from page 22

bility of a slide over the tracks. Their salaries are reimbursed by the contractor.

In the fills four concrete underpasses or cattle crossings are being placed by the contractor so that local farmers will have access to their cutoff fields. Three of these rectangular underpasses are 10x12x86 ft.; a fourth is 10x10x 122. Walls are specified nine inches thick; top and bottom slabs, 10 inches. Concrete was subcontracted by Snook Bros., Corvallis, Ore. For the concrete, 117,800 pounds of reinforcing steel was purchased from Soule Steel Co. of Portland.

Trucks Use Underpasses

An interesting feature about these underpasses is that Atkinson, in order to run the large rock trucks over them to continue the fills, had to build them stronger than contract specifications. The contract stated no single axle should carry a load greater than 36,-000 pounds. As the Euclid single rear axle load exceeded that figure, the contractor reinforced one half of each underpass and is hauling over that half.

"What seems to be the hold-up here, men?"

A cement bridge was completed last May on the northern fill. Built on a separate contract by the State Construction Co., Seattle, Wash., this 112-ft. bridge stands high and dry by itself in the marshy bottomland. Atkinson is now laying the fill to and beyond it but is detouring heavily-loaded trucks around the bridge.

One sideline project done by the contractor was the relocation of 800 feet of the old highway. Necessary because the old road curved too close to the edge of the cliffs, this small job was done directly above where the 54-B is working and while traffic was using the road.

Maintenance Setup

Equipment maintenance is considered very important on this project, especially because of the heavy rock the machines are handling. Ernie Ford, master mechanic, is in charge of all equipment maintenance and the repair shop. He deserves as much credit as anyone for the good progress so far. His shop is a large, open-front shed with a parts room at one end. Two van bodies from transport trucks also serve as parts and supply rooms. These, easily transported from job to job, require no erection when moved in and are always dry.

For greasing the shovels and dozers a portable outfit on a small truck is used. For the trucks a ramp-type grease rack was placed to the left of the garage with ramps at both ends.

The grease rack was built of wood and to the usual strength of such a truck rack. At first it was used without any complications for greasing the 20-yd. Sterlings and Westerns. But Ernie

SLASH COSTS
with Sauerman Machines

DEEP, WET EXCAVATION

Sauerman Slackline Cableway digs reservoir 400'x200' in area and places the spoil (80,000 cu. yd.) in a single pile.

HEAVY EARTH HANDLING

This large Crescent scraper with carrier is working on a coal stripping job. It is making a cut 300 ft. wide, 60 ft. deep and moving over 6,000 cu. yds. of overburden a day.

THREE main economies are assured by using Sauerman Scraper or Cableway Machines for long haul work such as moving gravel out of pits or ponds, stripping, stock-piling, bank excavation, dam and levee construction, etc. These economies are:

(1) Digging, hauling and automatic dumping are merged into a continuous, rapid operation controlled by one operator.

(2) Power requirement is moderate.

(3) Maintenance is simple.

Sauerman machines offer handling capacities from 10 to 600 cu. yd. per hour and operating spans from 200 to 1000 ft. or more. Specifications of the various sizes and types of machines, together with illustrations of their uses are given in the Sauerman catalogs. Write for this literature today.

SAUERMAN BROS., INC.
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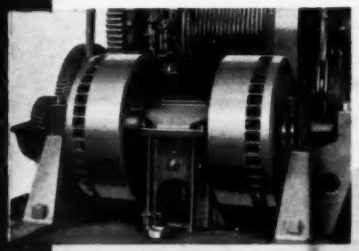
THE P&H MAGNETORQUE replaces the old frictions for swing and propel motions—transmits power electro-magnetically. It's smoother, more dependable, thoroughly proved.

*T.M. of Harnischfeger Corporation for electro-magnetic type clutch.



Ford found it dangerous when the new Euclids were brought to the project. With all the weight on one rear axle, these 17-yd. trucks placed a tremendous burden on the rack. So Ernie Ford strengthened it.

A 105-cfm Sullivan electric-powered compressor furnishes air for the shops. Richfield fuel, oil, and grease has been contracted for the entire project. As the daylight shift ends at 4:30 p. m. and the night shift does not start until 5:30, the trucks are run over the grease rack during the hour interval as well as during the early hours of the morning. The daily greasing is a ritual. Because of the electric shovel, an electrician has been added to the maintenance crew.

9-Hour Shifts

During the good summer weather the crew is running two 9-hour shifts, five days a week, on the loading and hauling. Day shift is 7:30 AM to 4:30 PM; the night shift, 5:30 PM to 3:30 AM.

For supervisory personnel and maintenance two Ford sedans and seven Ford pickups are on the project. Field office is a large, aluminum house trailer which was designed especially for the contractor. It contains two compact and complete offices for the project manager and assistant project manager as well as a larger office for the paymaster and secretary. Its tandem-axled wheels come off when on a project. A section of the floor is slid in place to replace the wheels and fender wells—therefore the middle office in this trailer is not cramped by the fender wells common to most trailers.

E. G. Nettleton is resident engineer for the Washington State Highway Department.

Project Manager Booth hopes to beat the weather on all the long bottomland fill. From the way the crew is moving rock at present, it looks as if he will win—at a walk.

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FOR
PROFITABLE PERFORMANCE AND ECONOMY OF OPERATION
A Complete Line of DRAGLINES, POWER SHOVELS, CRANES, BACKHOES, PILE DRIVERS
Crawler and Pneumatic-Tire Mounted
Diesel, Gas, Electric, ⅜ to 2½ Cu. Yd.

There are a number of important, time-saving and money-making features built into every Osgood unit—complete *Air Control* of basic motions; an *Air Cushion Clutch* that provides top speed almost instantly, without lag, without grab or jerk; adjustable *Hook Rollers*, operating on the underside of the rotating gear to keep the upper body stabilized on the crawler truck frame . . . fewer wearing parts, greater accessibility of machinery, larger diameter power-operated frictions, and many similar advancements.

Look to Osgood for cranes, shovels, draglines, backhoes, and pile drivers that will give you more work every day, better performance, easier operation, longer life, larger profits!

POWER SHOVELS • CRANES • DRAGLINES • CLAMSHELLS • BACKHOES • PILE DRIVERS

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MARION OHIO

DIESEL, GASOLINE OR ELECTRIC POWERED • ⅜ TO 2½ CU. YD. • CRAWLERS & MOBILCRANES

Bull Shoals

Continued from page 17

which marks the quarry floor. The 9-in. holes are not sprung—column-type shooting is being used entirely. The holes are loaded with 8-in. by 50-lb. sticks of Hercules powder. The 83-ft. holes take 2,000 pounds of powder each—300 of 65% Gelamite and 1,700 of 50% Hercomite. Two shots of 17,000 to 20,000 pounds every other week bring down enough rock to keep the crushers running full blast. A 46,000-lb. shot has been the biggest so far.

The 29-T holes, like the smaller ones, are set off by Primacord detonating fuse. A main trunk line is laid along the row of holes, and Primacord from each hole hooks into this main line. An electric blasting cap at the end of the trunk line explodes the whole works at a high rate of speed calculated to increase the normal efficiency of the powder.

Wagon Drilling

Limited additional drilling in certain areas has also been found necessary, between and in front of the blast holes. This work is being done by four Ingersoll-Rand wagon drills, which receive their compressed air from 500- and 265-cfm compressors, both Chicago Pneumatics. Standard Ingersoll-Rand drill steel in maximum lengths of 20 feet is being used, with I-R detachable Jackbits. It ordinarily requires about four bit changes to neck down to a finished hole diameter of 1⅝ inches, and each machine drills about 200 feet per shift.

Wagon drill bits and steel are re-

A big new EASTON Type TL lift-door trailer powered by a Mack tractor. Loading in a cement plant quarry.

Big, and Easy-Going

they last longer and get more done

Big, smooth and easy. They cut costs because they cut out those *extra* trips. They take *bigger* loads at *safer* speeds. No wasted motion, no wasted effort. They wind up every day with more tons hauled *at lower cost.* Take it easy with *big* EASTON Special Purpose Trailers. For a free time and cost study of EASTON Trailer Haulage on your property write to Easton Car & Construction Company of Easton, Pa.

EASTON TYPE TL TRAILER

A thirty-ton EASTON lift-door trailer, powered by a Euclid tractor. Easton Trailers serve with all makes of commercial or off-highway truck tractors. Dumped by overhead hoist.

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SPECIAL PURPOSE

EASTON *Trailers*

Type TRB • 14 to 20 tons

Type TL • 20 to 30 tons

Type TD • 20 to 30 tons

ALSO EASTON MINE AND QUARRY CARS AND EASTON HEAVY-DUTY TRUCK BODIES

USED EQUIPMENT
OK by SOUTHWORTH

Let dependable used equipment earn you money from the start with long life and top performance guaranteed by our years of experience in selling and servicing the great names in construction equipment and 25 job-trained mechanics in a modern, efficient shop.

1946 ATHEY Wagon PD10 with all new tires. Rebuilt and Guaranteed. $5900.

CATERPILLAR D4 Tractor with LaPlant-Choate Angledozer. Rebuilt and Guaranteed. $4200.

CATERPILLAR Diesel Tractor D7 LaP-Choate Hyd. Dozer. Rebuilt and Guaranteed. $8500.

1948 CATERPILLAR Tractor D4 Athey Mobiloader. Only 350 hours. Guaranteed. $8500.

CATERPILLAR Diesel Motor Grader No. 12 Cab, lights, heater, scarifier. Excellent condition. Rebuilt and Guaranteed. $7000.

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GLENWOOD ROAD — TRACTOR & MACHINERY CO. INC. — MENANDS, NEW YORK

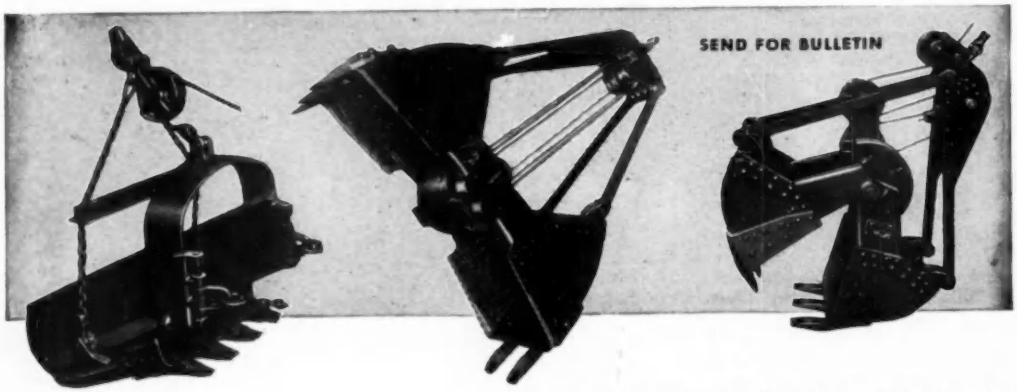
ALBANY, NEW YORK TELEPHONE 5-5255

worked in a bit shop at the dam, where an all Ingersoll-Rand shop is set up. There is a Size 500 drill steel cutter and shank grinder here, as well as a steel sharpener, a steel furnace, a jack furnace, a jackmill, a salt bath draw furnace and a bit grinder. The shop is situated at the dam because of very heavy drilling and shooting necessary to clean off the abutments and expose bedrock across the stream valley floor.

Wagon drill holes are loaded with Hercules 1½x8-in. cartridges of powder, or with bag powder, and set off with the main blast hole drilled shots.

After a shot has brought thousands of tons of stone thundering down to the quarry floor, a Bucyrus-Erie 120-B electric shovel has work to do. Electric power for this rig comes in from a nearby 2,300-v AP&L power transmission line and reaches the machine by means of a flexible cable between the 120-B and a transformer station.

The large scale shooting is bound to leave behind a few oversize rocks, so as the 120-B comes to these stones, it throws or rolls them over to one side, where a Caterpillar D-8 tractor and Caterpillar bulldozer blade can reach them. This machine then pushes the large stones over to one side in a



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WELLMAN
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● Count on longer life and more efficient service ... due to Wellman original **welded rolled steel construction.** You get the maximum digging power, and exceptional strength—without excessive weight! Specify Wellman, and you'll specify the best bucket for your purpose.

THE WELLMAN ENGINEERING COMPANY
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TRUCK-SPEED TRAVEL MEANS MORE DIGGING

Truck-mounted Hydrocranes highball out to a job site in short order — set up in a few minutes — finish light excavating jobs before slow moving equipment even gets started. Here's what a few owners say:

Fast Hydrocrane travel speeds water and sewer trenching

"We find on our small sewer and water trenching jobs nothing can touch a Hydrocrane. It gets to a job and finishes it in far less time than a crawler mounted clam. Our jobs are plenty tough too, because the dirt in this area is a very hard clay."

O. E. Mannila V. J. Mannila
Jacobson Mill Company, Little Fork, Minn.

Hydrocrane saves from 20 to 70 percent on travel and set-up time

"Depending on the distance covered, our Hydrocrane saves from 20 to 70 percent in travel and set-up time over other equipment. We use it to dig cesspools, excavate holes for hydrants, and unload and set hydrants. In addition to getting around fast, the Hydrocrane works so smoothly we don't ever have to worry about fracturing a connecting joint when we set a hydrant."

John A. Webb
Gallo Construction Company, Sagamore, Mass.

Hydrocrane big time saver in travel and man hours

"Crawler type equipment can't compare to a Hydrocrane when it comes to travel speed. We use our machine for water trenching and digging farm sewer systems. The Hydrocrane is great for close quarter work. With the telescoping boom, we can work under tree branches and around all sorts of obstacles. The Hydrocrane cuts man hours 90 percent."

O. T. Oakes
O. T. Oakes Excavating Company
317 Kilbourne Ave., Tomah, Wis.

In addition to digging, you can use the Hydrocrane for countless hoisting and material handling jobs. Send coupon for full details.

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin 49M49C

BUCYRUS-ERIE HYDROCRANE DIVISION
South Milwaukee, Wisconsin

Gentlemen: Tell me how the Hydrocrane can speed up my jobs.

Name .....

Company .....

Address .....

City ..... State .....

pile. A small Northwest crawler crane with an 8,000-lb. breaking ball pulverizes the pile from time to time. While the D-8 is not busy cleaning up the quarry floor, it finds time to push the broken rock back where the 120-B can reach it.

Swinging a 5-yd. dipper, the output of the 120-B is so high that four 25-cu. yd. Maxi-built Cummins-powered custom trucks are required to take the material only 500 feet to the first crusher. There the broken stone passes through a primary rock crushing and screening plant, whose function is to reduce all rock to under six inches in size and screen off the dirt or other deleterious fines.

This plant consists of a 42-in. Allis-Chalmers powered gyratory crusher, a 42-in. belt conveyor which carries the outgoing rock to a dual set of triple deck Simplicity vibrating screens, a 30-in. Allis-Chalmers driven gyratory secondary crusher, and a 36-in. belt to take finished material out to the 20,000-ton stockpile. A 3/8-in. elongated slot screen in the screening unit removes dirt and other fines not suitable for concrete manufacture.

So efficiently is the quarry set up that it keeps up easily its end of the project. Quarry men at present work only five 8-hour shifts a week, and they put out all the stone which can be used on the dam. Concrete men at the dam are not exactly loafing—they have already passed the 100,000-cu. yd. per month mark and are increasing their production soon to top out somewhere around 175,000 cu. yd. per month.

Conveyor Has 21 Flights

The 7-mile conveyor belt line to the dam represented a primary clearing job in which Caterpillar D-8 bulldozers played an outstanding part. The line is composed of 21 separate flights, with maximum up grade of 28.3% and maximum down grades of 31.2%. A service road which parallels the conveyor line follows that general contour, up one hill and down the other.

Foundation work at Bull Shoals Dam has also been big-scale excavating. A cofferdam, built of concrete because steel sheet piles were not available at the time, was first built to enclose approximately 65% of the foundation area. This section was then stripped clean as a hound's tooth before concreting began. Second stage construction will see the top of the cofferdam blown off and the river passing through the outlet works. Then the section now covered by the river can be excavated. New cofferdamming around the remaining section will consist of buttress piers and concrete stop logs upstream and an earth dike downstream.

An extensive amount of drilling and shooting has been necessary to expose the solid rock abutments and river floor. Drilling equipment consisted of nine Ingersoll-Rand FM-2 wagon drills, with a Caterpillar D-8 service tractor to pull them around and clean up around the work area. These machines received air through a 6-in. header from one of three compressors totalling 6,500 cfm. Two compressors were Sullivans, the other, a Chicago Pneumatic.

Detachable Jackbits, stud bits and 14- to 16-ft. steel were all in evidence. Much of the initial stripping was loaded out to nine end-dump Euclid wagons by a Lima 802 and a Lima 1201 shovel, and sent down to the main campsite. The hard, weatherproof area on which the administration building, messhall, warehouse, hospital and other build-

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ings now stand can be credited to the intelligent disposal of this excellent material.

Hydraulic sluicing was also used, especially in cleaning the solid rock at the left abutment. Four-stage pumps supplied water under high pressure to the sluicing monitor. Concrete placing is now well under way, preceded and made possible by a big excavating job.

The White River Valley in the vicinity of Bull Shoals has long been recognized as a desirable location for a dam. In 1910 Congress approved an application of the Dixie Power Co. for construction of a dam about 10 miles below the present site, but a Presidential veto voided the action. In 1919 this company again obtained a construction permit, but could not finance the project. Later the White River Power Co. took over the project but was discouraged by the results of the foundation tests and abandoned it.

In a report submitted to Congress in 1931, the Wild Cat Shoals site, a few miles downstream from Bull Shoals, was included in a group of eight reservoirs which were selected as the most effective of 13 investigated. In a report submitted in 1937, the Chief of Engineers presented a comprehensive flood control plan for the lower Mississippi and Ohio Rivers which included recommendation for construction of six reservoirs in the White River basin. In 1938, Congress authorized expenditure of $25 million for the initiation and partial accomplishment of the program of construction.

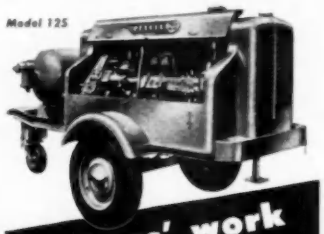
A report published in 1940 presented the Bull Shoals site as an alternate for the Wild Cat Shoals site, where foundation conditions were found to be unfavorable, and indicated that Bull Shoals Reservoir was economically justified for the combined purposes of flood control and the production of hydroelectric power. In 1941, Congress modified the comprehensive plan for the White River Basin to include the Bull Shoals Reservoir and authorized the expenditure of $24 million for the prosecution of the plan.

Thus was born the mighty concrete barrier now under construction, which will trap and hold the water from a watershed area of 6,036 square miles.

The names of men who have participated in designing and building Bull Shoals dam are legion, but some of the most important include Col. G. E. Galloway, USA, Little Rock district engineer at the time the dam was designed and started. His successor, Col. Thomas A. Lane, is now in charge, assisted by Lt. Col. Kenneth H. Newton as executive officer. John L. Kemple has been project engineer since March 1, succeeding Ralph Johnson who resigned to serve with the Atomic Energy Commission. Lincoln F. Sherman and Roy F. House are assistant project engineers, in general charge of field work.

The contractor's force, too, is numerous. It has to be to take care of a project of that size. M. H. Slocum is in general charge, assisted by Joe Shawver, quarry superintendent, and Ed Shipp, in charge of concrete operations. R. Norris directed excavation on the dam abutments.

Corps of Engineers personnel state that Bull Shoals Dam is being built to last a thousand years or more. What great changes its construction will bring about in Arkansas, Missouri and Oklahoma, only time can tell. Already Mountain Home, Cotter and Flippin are coming alive to their future opportunity. Plans are under way to distribute power over REA and private lines. Today Bull Shoals is merely a big dam; a dream come true. Tomorrow it may be an economic key to a new way of life for this part of the Ozarks.



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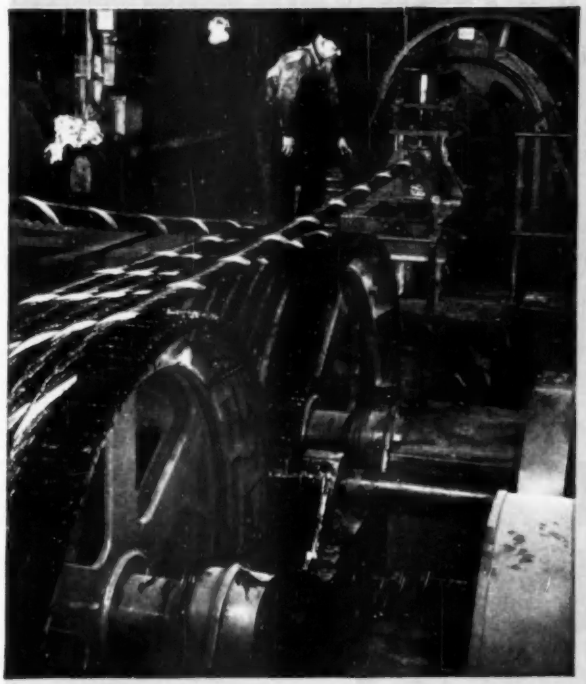
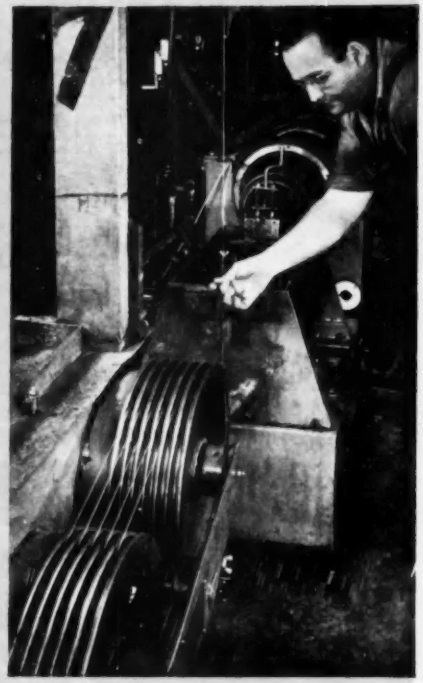
This photograph shows a 3 1/8" diameter Monarch Whyte Strand Wire Rope coming off a Macwhyte closing machine. Weight of this rope is approximately 16.65 pounds per foot. It has a strength of approximately 392 tons and is used for the digging line on large dragline excavator with 35 cu. yd. bucket.



In this photograph is a 3/64" diameter Stainless Steel Cord coming off a Macwhyte closing machine. It weighs approximately 0.35 lbs. per 100 feet; has a strength of approximately 270 pounds, and is used for many small cord needs.



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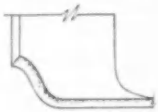

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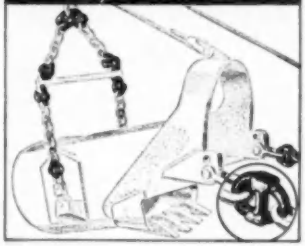

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Continued from page 35

between the cylinder and the combustion chamber, thereby reducing its area and greatly increasing the velocity of the air passing into the combustion chamber. This velocity reaches its maximum just before the piston reaches the top of its compression stroke. At this time the air is moving at fifty times crankshaft speed and into this swiftly revolving air the fuel is injected.

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The series is especially adaptable for uses in the fields of mining, construction and rock products.

Trailer-Mounted Generator

Manufacturer: International Diesel Electric Co., Inc., 13-02 44th Ave., Long Island City, N. Y.

Claims: A complete line of fully-equipped and self-contained trailer-mounted electric generator sets ranges in capacities from 10 to 85 kw. These units can be moved from location to location. They are recommended for road construction and maintenance, strip mining, bridge building and construction camps.

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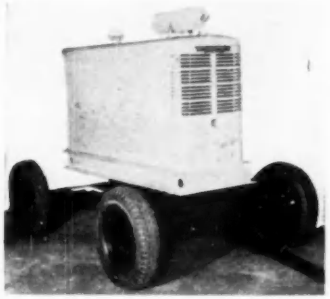

50 and 60 cycles, and in all standard voltages, these generator sets consist of an engine driving a generator, with an instrument panel containing all starting controls and switchgear, spring-mounted on a pneumatic-tired four-wheel trailer. The trailer is equipped with a steel angle drawbar for attaching to truck or tractor.

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Manufacturer: Muller Machinery Co., Inc., Metuchen, N. J.

Claims: A new 3½-cu. ft. tilting

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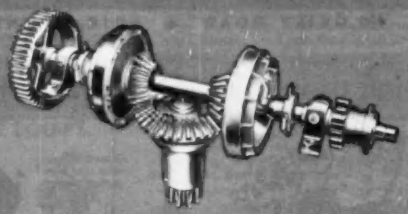

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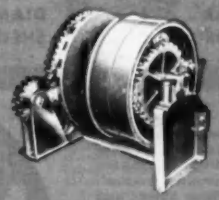

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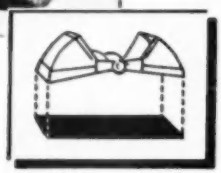

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BUCYRUS-ERIE 37-B combination shovel, dragline. Shovel front new 1948. Crawler tracks mostly all new 1949. Completely rebuilt. One owner. Machine in guaranteed condition. A real bargain at $13,500. Photograph can be furnished.

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BARGAINS
In Used Construction Equipment

MOTOR GRADER, CATERPILLAR, model 11, dual rear wheels, rear fenders, cab, 10-ft. blade. This machine has not been run since over $4,000 worth of parts were spent on it. Price $2,250

PUMP JAEGER, centrifugal, model 3XPB, 15,000 gallons per hour, mounted on two steel disc wheels, good working condition. Price $185

CONCRETE MIXER, SMITH, model No. 7, two pneumatic wheels, 4-cylinder engine. Nearly new. Price $695

ENGINE-POWER UNIT, CATERPILLAR D-6100, diesel, 47 H.P. intermittent duty. This engine was used for light work and is in very good condition. Price f.o.b. Louisville. Price $875

CATERPILLAR D6 TRAXCAVATOR, serial No. 9U180. This tractor is about 18 months old, has 1615 hours on hourmeter, and gives appearance of a new machine. A new Caterpillar D6 Traxcavator lists at $13,419.31. Our price on this outstanding value f.o.b. Paducah, Kentucky. Price $9,650

SCRAPER, LaPLANT CHOATE, model C-41, hydraulic. Struck capacity 2.9 cu. yd., heaped capacity 3.8 cu. yd. For use with any tractor equipped with hydraulic pump. Price $750

AIR COMPRESSOR, GARDNER-DENVER, model WHF210DB, serial No. 116096, equipped with Caterpillar D4600 engine, mounted on steel wheels. Used less than three months. Excellent condition. Price $5,675

RIPPER, KILLEFER, model 10A, equipped with steel wheels, this ripper has new cutting edges for the teeth. Requires D6 tractor when all teeth are used. Price f.o.b. Louisville. Price $350.

Write—F. L. Sennett, 800 West Main Street, Louisville, Kentucky for details and complete used equipment catalog.

ROY C. WHAYNE SUPPLY COMPANY
Evansville, Ind. Louisville, Ky. Paducah, Ky.

ESCO DRAGLINE BUCKET—6-yard heavy duty weight 13,765 lbs. Price bare bucket f.o.b. Merced, California $1800.

BUCYRUS-ERIE 120-B PAD—one complete set of 36" YZ steel flame hardened pads used thirty days.

Thurman & Wright
960 Russ Building San Francisco 4, Calif.

50% OFF

We have new parts for all size Hendrix buckets. Also parts for Page 2-yard and bushings, pins, etc. for ½-yard Owen clamshells. All offered at 50% off.

Send For Complete List
QUICK SERVICE CO.
1226 W. Adams St.
Chicago, Illinois

Dragline attachment for Bucyrus-Erie 54-B. Includes 80' boom, fairleads, drum laggings, high A-frame and 2½ yd. Daniels-Murtagh bucket. Located Pennsylvania. Price complete F.O.B. $4500. Box 3352

MECHANICS — HOME STUDY. Step up your own skill with facts and figures of your trade. Audels Mechanics Guides contain Practical Inside Trade Information in handy form. Fully illustrated. Easy to Understand. Highly endorsed. Check book you want for 7 days' Free Examination. Send no money. Nothing to pay postman. ☐ Carpentry $6, ☐ Auto $4, ☐ Oil Burners $1, ☐ Sheet Metal $1, ☐ Welding $1, ☐ Refrigeration $4, ☐ Plumbing $6, ☐ Masonry $6, ☐ Painting $2, ☐ Radio $4, ☐ Electricity $4, ☐ Mathematics $2, ☐ Steam Engineers $4, ☐ Machinist $4, ☐ Blueprint $2, ☐ Diesel $2, ☐ Drawing $2. If satisfied you pay only $1 a month until price is paid.

AUDEL Publishers
49 W. 23 St. New York 10, N. Y.

Continued on page 68

For Sale

Continued from page 67

Bucyrus-Erie 29-T electric blast hole drills arranged for operating on a power supply of 220/440 volts, 3 phase, 60 cycle current. Each drill equipped with a string of drilling tools, drilling line, sand line, bailer, circle jacks and a set of wrenches. Drills are available in the West and are to be reconditioned before sold. Box 3340

Placer Gold Dredge

8 cu. ft. diesel-electric, Bucyrus-Erie bucket-line dredge and necessary auxiliary equipment for a one dredge operation will be sacrificed at fraction of replacement cost. Dredge is in good mechanical condition; was built new in 1940. Digging depth, 30 ft. below water.

Equipped with two Ingersoll-Rand type S diesel engines. Byron-Jackson pumps, electrical equipment all General Electric. Sectionalized steel pontoon hull. Complete specifications and price on request. Dredge can be inspected in running condition at Sunbeam, Idaho. Address inquiries to Box 3337 care of Excavating Engineer.

Brand new Esco scoop lip dipper for Manitowoc shovel, complete with short bail. Immediate delivery. Price f.o.b. St. Paul, Minn. $3068.

J. L. Shiely Company **St. Paul 4, Minn.**

Two AX 7-yd. Bucyrus-Monighan Red Arch dragline buckets with teeth and chains. A-1 condition.

Atlas Coal Company, Inc.
Oskaloosa, Iowa

New Diesel Engines

2—Caterpillar D-8800 diesel engine, 4 cylinder 5⅜" x 8" with accessories.
1—Buda Lanova 4-DT-226 diesel engine 4 cylinder 3⅜" x 5¼" with accessories.

Being Offered at Bargain Prices

Bucyrus-Erie Company **South Milwaukee, Wis.**

A standard shovel front, ⅞ yard capacity, for a Lorain 41, purchased in March of 1947. Good shape. Contact Mr. P. C. Cochrane, contractor, of Sanford, North Carolina.

Bucyrus-Erie No. 8 bit dresser. Complete and in perfect operating condition. Located in Washington State. Box 3271

New Dragline Buckets

2—1¼ cubic yard Red Arch Type AX medium duty buckets.
2½ cubic yard Type AX dragline bucket. (Reconditioned.)
3 cubic yard Red Arch, Type AY heavy duty bucket.
5 cubic yard Red Arch, Type AY heavy duty bucket.
6 cubic yard Red Arch, Type AY heavy duty bucket.

Bucyrus-Erie Company
Parts Division
South Milwaukee, Wisconsin

Two Bucyrus-Erie model 27-T blast hole drills, gasoline powered, completely overhauled, including 6" tools. Located northern Minnesota. Box 3345

1—Bucyrus-Erie AXY Red Arch, 8 cu. yd. dragline bucket together with 103 parts and accessories. Mid-western location. Slightly used. Box 3335

WANTED

WANTED: Used one yard crane or shovel. Box 3356

WANTED: One used standard make gravel crushing and washing plant—capacity, 75 to 100 tons per hour. Box 3355

Wanted: 1—120 ton per hr. rock crusher, jaw-type, capable of handling 24" to 30" sizes of rock, reducing to 3" size; also one secondary hammermill rock crusher for reducing from 3" size to fine sizes—also elevators and screens for same. Box 3349

WANTED—One 55 foot crane boom for one-yard Osgood Conqueror, Serial No. 2282. Box 3357

Wanted: Complete chain crowd shovel front end equipment for Bucyrus-Erie 32-B dragline. Box 3319

Wanted—for a one-yard Osgood Conqueror gas shovel serial number 2282, one 55 foot crane boom and one-cubic yard clam bucket.

Rupp Construction **Marshallville, Ohio**

HELP WANTED

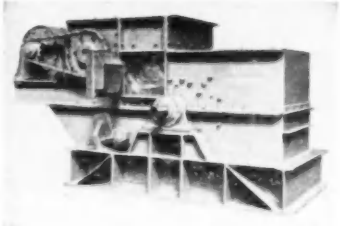
Construction superintendent wanted. At least ten years' experience. Under 50 years of age. In complete charge of project consisting of 2 miles of large sanitary sewer piping for established construction company in New Jersey. Capable of handling all types of sanitary sewer projects. Familiar with estimating. Furnish experience record and complete data. Good salary. Box 3351

POSITIONS WANTED

Construction superintendent available, twenty years experience all types of projects. Good health and do not drink. References from established reliable firms. Box 3358

Gen. supt. or supt. available. Experience covers 25 year supervising, estimating and building all classes of excavating; railroads; highways; airports; earth-fill dams; large sewers. Honest, sober, reliable. Best of references. Salary open. Box 3336

BULLDOG
Non-Clog • Moving Breaker Plate
HAMMERMILLS



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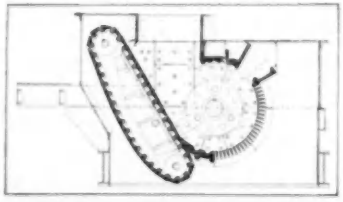
PULVERIZE
...any reducible material
— regardless of moisture or plasticity



PRIMARY • SECONDARY
FINE REDUCTION
1 to 1000 TONS PER HOUR
Submit your reduction problems to our engineers.
Completely illustrated booklet on request.

HAMMERMILLS, INC. 1021 BIG BEND BLVD. ST. LOUIS, MO.

New trade literature

Title: **Mines Handbook**
Subject: The 1949 Canadian mines handbook shows that 52 mining companies in Canada are searching for uranium while the number of gold hunters has dwindled. The book lists principal companies and a summary of their operations of the past year, including comparisons with previous years. It contains 360 pages.
Where To Get: Northern Miner Press, Ltd., 122 Richmond St., West, Toronto, Ontario, Canada. (Price, $2)

Title: **Equipment Catalog**
Subject: A new catalog presents a full line of equipment—pumps, compressors, concrete plaster and mortar mixers, paving machinery, truck mixers, towers and hoists. Illustrations and specifications along with performance figures are included. Another smaller bulletin contains pictures and data on the bantam pump, a small, compact, portable pump made by the same manufacturer.
Where To Get: Jaeger Machine Co., 550 W. Spring St., Columbus, 16,

Ohio. The complete line catalog is No. GC-9. The bantam pump is featured in Bulletin LP-9. (Both are free.)

Title: **Operating Cost Guide**

Subject: Owners of power cranes and shovels will find this bulletin helpful in estimating the cost of ownership, operation and maintenance for their equipment. It analyzes the various expenses which must be considered if profitable operations are to result. Under fixed costs are depreciation, interest, taxes, insurance, repairs, maintenance and supplies; under operating costs, engine fuel, lubricating oil and labor. The breakdown of costs should be of interest to contracting engineers, highway and public works administrators and plant and material handling engineers as well as to owners of cranes and shovels.

Where To Get: Power Crane and Shovel Association, 74 Trinity Place, New York 6, N. Y. Ask for Technical Bulletin, No. 2. (Price, 50 cents)

Title: **Concrete Delivery**

Subject: A new 8-page, 3-color pamphlet contains on-the-job pictures showing non-agitating delivery and placement of concrete on jobs as small as sidewalks and those as large as the Bureau of Reclamation dams. The booklet also describes the conversion of the Dumpcrete body for hauling bulk cement, coal, earth and other materials that "flow."

Where To Get: Dumpcrete Division, Maxon Construction Co., Inc., 131 N. Ludlow St., Dayton 2, Ohio. Ask for Dumpcrete pamphlet, L-106. (Free)

Title: **Storage Catalog**

Subject: A new catalog describes various techniques of storing and reclaiming bulk material by means of power drag scrapers. Its 36 pages contain 100 illustrations of material-handling problems with explanations of their solutions. Storage of sand, coal, heavy ores and crushed stone is included. Six pages of specifications give details of component parts of the scraper equipment.

Where To Get: Sauerman Bros., Inc., 574 S. Clinton St., Chicago 7, Ill. Ask for Section E, Catalog 19. (Free)

Title: **Expense Manual**

Subject: The AGC has revised the Contractors' Equipment Ownership Expense manual. Nearly 1,400 items have been added along with tentative percentages. Sample costs in dollars for the various listings are omitted. Space is left, instead, so that the contractor can insert the actual price paid for his machinery and equipment to which the percentages apply. The manual is a compilation of data on average costs of owning and operating various kinds of construction machinery and equipment.

Where To Get: Construction Foundation, 1227 Munsey Bldg., Washington 4, D. C. (Price, $1 for a single copy; $10 for 12; $65 for 100)

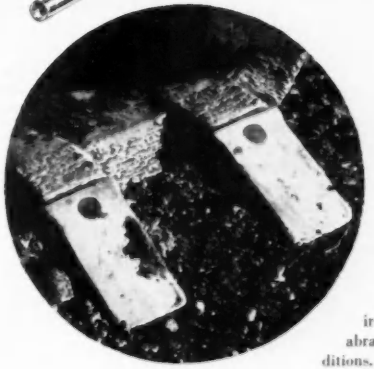
Title: **Motor Grader Booklet**

Subject: A new 16-page booklet features photographs of such motor grader operations as casting ditched material to the center of the road, mixing and spreading asphalt surfacing material, backsloping, and drainage ditching. Descriptive on-the-job stories accompany the pictures. Cross-section photos of the engine, transmission and drive gears are included.

Where To Get: Caterpillar Tractor Co., Peoria, Ill., or any Caterpillar dealer. Ask for Form 12255. (Free)

FOR HARDFACING AND REPAIR

Amsco WELDING PRODUCTS



Amsco No. 459

Increases life 2 to 5 times for dippers, pug mill knives, brick dies, shredder knives, drag chain links, pulverizer hammers, sand pumps, and similar parts. Amsco No. 459 is centrifugally cast . . . resists softening up to 800°F . . . and has a Brinell hardness of 500-600. No. 459 produces a chrome-moly martensitic iron deposit and is designed for severe abrasion service with moderate impact conditions.

The application above shows Amsco No. 459 applied to the front and teeth of a manganese steel walking dragline bucket, used for stripping overburden from iron ore at a Minnesota mine. In similar applications where more severe impact coupled with abrasion is encountered, Amsco Economy Hardface is recommended.

Ask for free reprint of *Hard Surfacing by Fusion Welding*

American Brake Shoe Company

AMERICAN MANGANESE STEEL DIVISION
373 EAST 144th STREET • CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. Made and sold in Canada by Canadian Ramapo Division of Joliette Steel Ltd., Niagara Falls, Ont.

Notes from the manufacturers

U. S. Rubber Co., New York, N. Y., has named Matthew J. Delehaunty district sales manager for the Pittsburgh, Pa., branch of the mechanical goods division, directing sales of hose, conveyor belts, packing and the other industrial rubber products. He succeeds J. W. Greenwalt who has retired from the company. Delehaunty is a veteran of 27 years of service with U. S. Rubber. He joined the company in 1922 as a clerk in the Pittsburgh branch, specialized in the sale of the company's wire products, and served in various administrative and sales capacities. In 1937 he became a salesman for the mechanical goods division with headquarters in Pittsburgh. He held this position until his new appointment.

DREDGES

HYDRAULIC
DIPPER
CLAMSHELL

Bolted sectional steel hulls for landlocked, inland waters

If you need a dredge, write us!

AMERICAN STEEL DREDGE CO. INC.
FORT WAYNE 1 · INDIANA · U.S.A.

DESIGNERS AND BUILDERS OF DREDGING EQUIPMENT SINCE 1905

Harnischfeger Corp., Milwaukee, Wis., has announced that A. J. Rinnander will supervise field activities, Zip-Lift hoist distributors and sales on a national basis under the direction of E. W. Potratz, manager of hoist & Trav-Lift crane division. Rinnander was formerly with Chicago Pneumatic Tool Co., New York, N. Y.

Stoody Co., Whittier, Calif., has announced the addition of two distributors for its line of hardfacing alloys —Morris, Wheeler and Co. of Philadelphia, and Silver Welding Supply Co. of Boston. The former, at Fox Street and Roberts Avenue, will cover eastern Pennsylvania and the States of New Jersey, Delaware, and Maryland. The area served by Silver Welding, 1758 Centre St., West Roxbury, is the eastern half of Massachusetts.

Acrow, Inc., New York, N. Y., has appointed distributors in the southern states. Southern States Equipment Co., 425 Celeste St., New Orleans 11, La., will cover Louisiana. J. E. Ingram Equipment Co., 1146 W. Laurel, San Antonio, Tex., is new distributor in 13 counties in southern Texas. Cochran Equipment Co., 200 Portwood St., Houston, Tex., has been named to handle 34 counties in southeastern Texas. Acrow has also named Minneapolis Equipment Co., 520 SE Second St., Minneapolis, Minn., distributor for the State of Minnesota and 22 counties in the State of Wisconsin.

R. G. LeTourneau, Inc., Peoria, Ill., has reorganized its service department into Eastern, Central and Western territories. This new set-up aligns the function of this department with those of the sales organization. Cloyd W. Richards as general service manager heads the department. Pat Edwards is Eastern service manager; George Crafton, Central service manager, and Jack Lewis, Western service manager. Their territories correspond to the Eastern, Central and Western sales areas. All headquarter at Peoria and direct activities of service engineers assigned to their respective territories, and supervise handling of the service needs on all LeTourneau products in their areas. Clyde E. Clair has been named special service representative with offices at Peoria. He will handle special service assignments.

Hercules Powder Co., Explosives Department, Wilmington, Dela., has announced two new promotions. J. J. Kelleher has been named assistant sales manager, a newly-created post, and L. C. LeBron has been appointed to succeed Kelleher as manager

HAYWARD BUCKETS

WON'T QUIT OR CAUSE TIME OUT

A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.

THE HAYWARD CO.
52-54 Church Street
New York, N. Y.

PONDEROUS EQUIPMENT

"Everywhere" IS MOVED *"Everywhere"*

ROGERS

EXPERIENCE builds 'em PERFORMANCE sells 'em

ROGERS BROTHERS CORPORATION
136 ORCHARD ST. ALBION, PA.
Export Office: 50 Church Street, New York 7, New York
Cable Address: "Broscites"

on ROGERS HEAVY DUTY TRAILERS

OUTPUT WANTED
Limestone quarry requires shovel to feed cement plant working at top capacity. Strength, efficiency, durability are essential.
Box 120-B
Wanted

Looking for STEADY OUTPUT?

You don't have to look any farther than Bucyrus-Erie to find a shovel that meets your output needs with dependable, long-life service. That's because Bucyrus-Eries are quality-built for tough digging.

The 5-cu. yd. 120-B, for example, is one of the Bucyrus-Erie quarry and mine shovels that has proved its worth in many corners of the world. It has plenty of speed, power and strength to boost output . . . sturdy construction, easy maintenance and smooth operation to keep it on the job with low maintenance costs. The result is a machine able to set new output records with outstanding economy of operation. For top performance at all times, choose Bucyrus-Erie — for only Bucyrus-Erie gives you the "years ahead" design that means years of profits ahead!

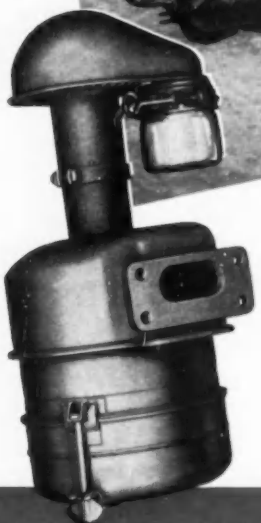
65L49c

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

KEEPING ABREAST OF POWER PROGRESS . . . . . .

New D2, D4, D6, CATERPILLARS
are equipped with
DONALDSON
AIR CLEANERS



Making molehills out of mountains is duck soup for rugged "Cats." No job is too tough.

Since 1935 all Caterpillar engines have been Donaldson equipped, and for this new series of tractors, Caterpillar engineers again chose Donaldson Air Cleaners.

New developments in power machinery often present new problems in dust protection. Donaldson research, engineering and testing facilities are available to all manufacturers in solving these problems.

DONALDSON CO., INC.
666 PELHAM BLVD., ST. PAUL 4, MINN.
DONALDSON CO. (CANADA) LTD. CHATHAM, ONTARIO

DONALDSON *Oil-Washed* AIR CLEANERS

SALES ENGINEERS: CHICAGO • DETROIT • CLEVELAND

of the contractors division. Kelleher had held that position for several years. LeBron, who joined Hercules 20 years ago as a member of the company's sales and service organization at Birmingham, Ala., became Kelleher's assistant early in 1948.

LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa, has appointed J. W. Schoen to the position of sales manager, replacing E. R. Galvin who has resigned. Schoen joined LaPlant-Choate in 1943. Since then he has served the company progressively in the treasury and sales departments and until his recent appointment, was assistant to the general sales manager.

Mack Trucks, Inc., New York, N. Y., has appointed John G. Caley district manager of the Birmingham, Ala., direct factory branch. In assuming his new duties, Caley relinquishes those of manager of the national accounts department for the Southern division.

Nordberg Mfg. Co., Milwaukee, Wis., has appointed H. N. Propp as assistant district manager, Central territory, for the crusher and process machinery divisions. J. B. Bond is district manager of the Central territory with offices at the company's Milwaukee plant. Propp was transferred from the San Francisco district office where he served as sales engineer for the past year. He joined Nordberg in 1941 following associations with several western metal mining companies. He is being succeeded in San Francisco by J. W. Crandall who will serve under T. D. Davis, district manager.

C. R. Jahn Co. has moved its sales and general executive offices, formerly located at 1106 W. 35th St., Chicago, to 212 Main St., Savanna, Ill. The Jahn factory has been located in Savanna for several years.

ONE
DEEP PENETRATION

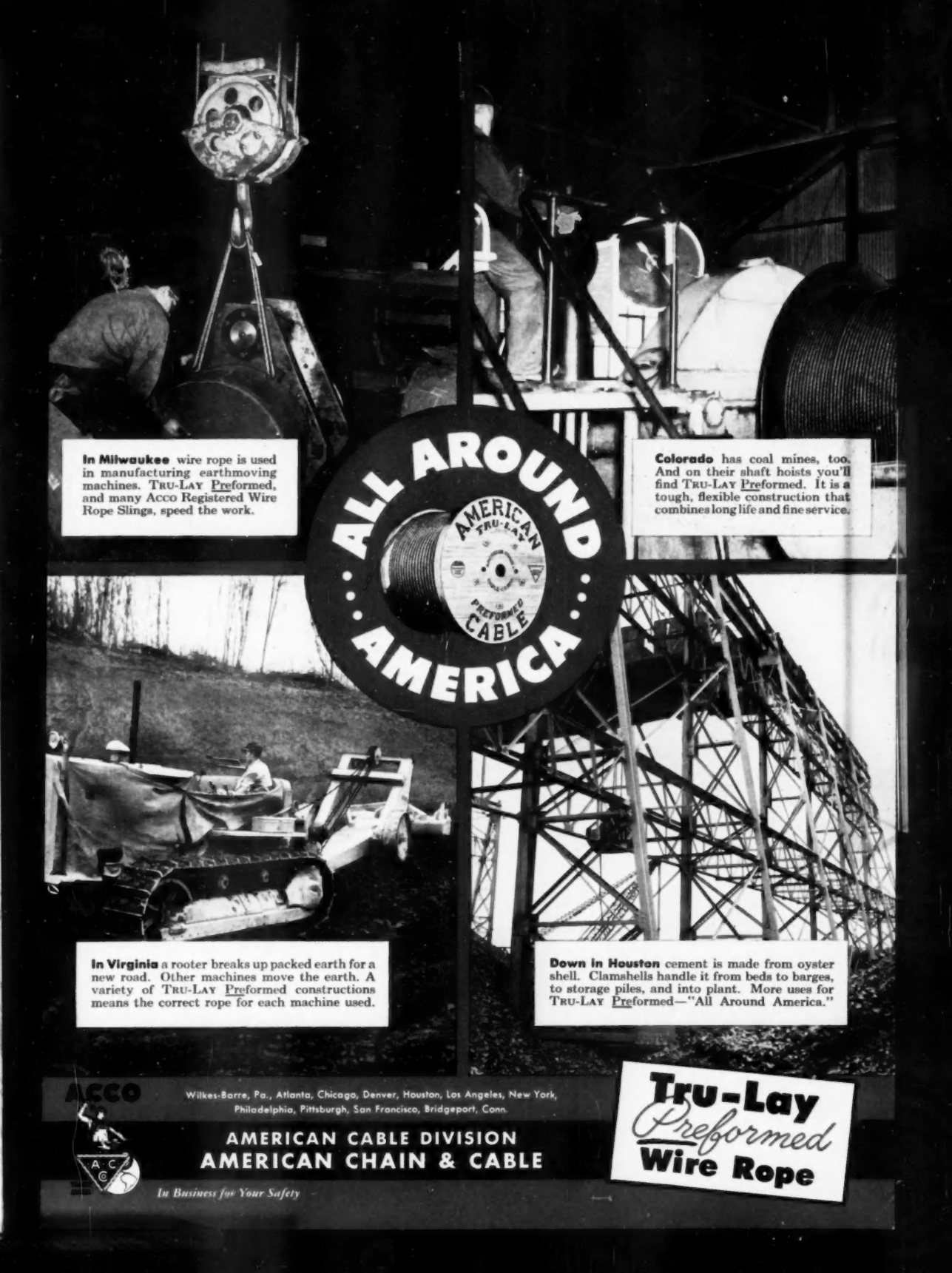
TWO
FULL LOADING

THREE
EASY DISCHARGE

A MOUTHFUL AT EVERY BITE

Owen Buckets
for HI-SPEED OPERATION

THE OWEN BUCKET CO.
6095 BREAKWATER AVE., CLEVELAND, O.
BRANCHES: New York, Philadelphia, Chicago, Berkeley, Cal.


ALL AROUND AMERICA
AMERICAN TRU-LAY PREFORMED CABLE
In Milwaukee wire rope is used in manufacturing earthmoving machines. TRU-LAY Preformed, and many ACCO Registered Wire Rope Slings, speed the work.
Colorado has coal mines, too. And on their shaft hoists you'll find TRU-LAY Preformed. It is a tough, flexible construction that combines long life and fine service.
In Virginia a rooter breaks up packed earth for a new road. Other machines move the earth. A variety of TRU-LAY Preformed constructions means the correct rope for each machine used.
Down in Houston cement is made from oyster shell. Clamshells handle it from beds to barges, to storage piles, and into plant. More uses for TRU-LAY Preformed—"All Around America."
ACCO
Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.
AMERICAN CABLE DIVISION
AMERICAN CHAIN & CABLE
In Business for Your Safety
Tru-Lay Preformed Wire Rope

LOW COST PER UNIT OF WORK

Suppose you're considering two competitive brands of wire rope. They look alike, but one sells for a little less than the other. Bargain? Often it's anything but a bargain. For purchase price alone isn't the measure of wire-rope economy.

Sometimes you may find a wire rope with a lower price tag than Bethlehem's. But how does the cheaper one compare in total service rendered? How about its *Cost per Unit of Work?*

What a unit of work is depends, of course, upon the industry involved. It can be a ton of rock moved by a power shovel. Or a car of coal hauled up a slope. Or a ton-mile in oil-country rotary drilling. But in any case, unless your final rope Cost per Unit of Work is *low*, the rope has not done an economical job for you. That's why first cost—purchase price—isn't the sole yardstick.

Bethlehem wire rope is a quality product, one conscientiously built for long-range economy. When you buy it, you are spending your money wisely. You are buying wire rope that means, in the truest sense, *low* Cost per Unit of Work.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation